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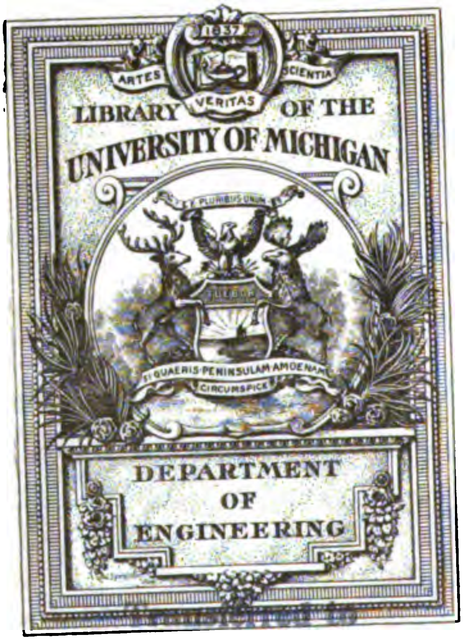

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THE OFFICIAL

GOOD ROADS YEAR BOOK

OF THE

UNITED STATES

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COLORADO BUILDING
WASHINGTON, D. C.

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GOOD ROADS YEAR BOOK

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TABLE OF CONTENTS

Page
Advertising ... 137-169
Alabama ... 19, 68, 89, 99, 219, 238, 280, 335, 431. 454
Alaska ... 219, 335
American Highway Association ... 348, 351, 425, 478
American Road Builders Convention ... 2
American Road Congress ... 2
Ancient Road Builders ... 6
Arizona ... 20, 68, 89, 99, 219, 240, 280, 335, 432, 454
Arkansas ... 20, 68, 89, 99, 220, 242, 281, 335, 432, 454
Asphalt Blocks on Country Roads ... 127
Associations ... 424
Austria-Hungary ... 13
Automobile Legislation ... 99
Bituminous Macadam Roads ... 119
Bond Issue Legislation (local) ... 68
Bond Issues ... 501
Bridge Designs ... 204 205, 206
Bridges and Culverts ... 197
Brick Roads ... 122
Bulletins, Circulars and Documents ... 329
California ... 21, 69, 99, 220, 234, 242, 281, 335, 432, 454
Cast Iron Pipe Culverts ... 201
Concrete Bridges and Culverts ... 200
Concrete Roads ... 124
Colorado ... 22, 69, 89, 100, 220, 243, 282, 336, 454
Connecticut ... 23, 70, 89, 100, 220, 244, 282, 336, 433, 454
Convict Labor ... 455
Convict Labor Laws ... 89
Corrugated Iron Pipe ... 201
Culvert Designs ... 203, 205
Delaware ... 24, 70, 90, 100, 221, 244, 283, 336, 454
Denmark ... 13
District of Columbia ... 25, 100, 221, 246, 336
Drainage ... 110, 117
Dust Preventives ... 134
Earth Roads ... 110
England and Wales ... 14
Expenditures 1913 ... 280, 297
Federal Aid ... 3
Florida ... 25, 70, 90, 100, 221, 246, 283, 336, 454
France ... 14
French as Road Builders ... 7
Funds Available 1914 ... 280, 300
Georgia ... 15, 70, 90, 101, 221, 246, 283, 336, 433, 454
Germany ... 15
Government Inventory of Post Roads ... 4
Grades and Alinement ... 111
Gravel Roads ... 115
Great Road Builders ... 9
Highway Engineering Education ... 396

265886

Page

Highway Officials 219
History of Road Building 6
Idaho 25, 70, 90, 101, 222, 246, 283, 336, 454
Illinois 25, 71, 90, 101, 222, 247, 284, 337, 435, 454
Important Events in Road Movement during 1913 1
Indiana 26, 72, 90, 101, 223, 248, 284, 337, 436, 454
International Road Congress 1
Iowa 26, 72, 91, 102, 223, 248, 285, 337, 436, 454
Italy 16
Kansas 27, 72, 91, 102, 223, 250, 285, 338, 436, 454
Kentucky 27, 73, 91, 102, 223, 250, 285, 338, 437, 454
Legislative Development 3
Lincoln Highway 5
Local Road Legislation 62
Louisiana 28, 73, 91, 102, 224, 251, 285, 339, 438, 454
MacAdam, John Loudon 10
Macadam Roads 117
Magazine References 351
Maine 29, 74, 91, 102, 224, 252, 286, 339, 438, 454
Maintenance 129, 130
Manufacturers, List of 459
Maryland 31, 74, 91, 102, 224, 252, 287, 339, 438, 454
Massachusetts 32, 74, 92, 103, 207, 224, 254, 287, 339, 440, 454
Massachusetts Specifications for State Highways 207
Michigan 34, 74, 92, 103, 224, 235, 255, 288, 340, 440, 454
Mileage of Roads 454
Minnesota 36, 74, 92, 103, 225, 235, 256, 288, 340, 440, 454
Mississippi 38, 75, 92, 103, 225, 258, 288, 341, 441, 454
Missouri 38, 76, 92, 103, 225, 257, 289, 341, 441, 454
Mixing Method 120, 211, 214
Montana 39, 76, 92, 104, 226, 258, 289, 341, 412, 454
Nebraska 40, 76, 93, 104, 226, 238, 289, 341, 442, 454
Nevada 41, 77, 93, 104, 226, 258, 290, 341, 454
New Hampshire 41, 77, 104, 226, 259, 290, 341, 454
New Jersey 43, 77, 93, 104, 227, 259, 290, 342, 443, 454
New Mexico 44, 78, 93, 105, 227, 259, 291, 342, 443, 454
New York 25, 78, 94, 105, 227, 262, 291, 342, 443, 454
North Carolina 47, 78, 94, 105, 228, 264, 292, 343, 443, 454
North Dakota 48, 79, 94, 105, 228, 265, 292, 344, 447, 454
Norway 17
Office of Public Roads, U. S. 219, 237, 329, 421
Ohio 48, 79, 94, 106, 228, 266, 293, 344, 447, 454
Oklahoma 52, 80, 95, 106, 229, 267, 293, 344, 447, 454
Oregon 53, 81, 95, 106, 229, 267, 293, 345, 447, 455
Organization Charts:
  California 234
  Massachusetts 235
  Minnesota 236
Patented Methods of Road Construction 313
Patents Issued in 1913 301
Penetration Method 121, 208
Pennsylvania 53, 82, 95, 106, 229, 268, 293, 345, 455
Periodicals 349
Piers and Abutments 198
Pipe Culverts 200
Principle Inventions 11
Progress Reports 237
Revision of State Road Laws (proposed) 5

Page

Rhode Island.................... 54, 82, 96, 107, 229, 269, 294, 345, 448, 455
Road Machinery.................... 417
Road Maintenance and Repair.................... 129
Road Systems of Foreign Countries.................... 13
Roman Road Builders.................... 6
Russia.................... 17
Sand Clay Roads.................... 113
Sectional Cast Iron Culverts.................... 201
South Carolina.................... 55, 82, 96, 107, 229, 270, 294, 345, 448, 455
South Dakota.................... 55, 82, 96, 107, 230, 273, 294, 346, 449, 455
Spain.................... 17
Specifications for Highways.................... 207
Split Log Drag.................... 131, 133
State Bond Issues.................... 4
State Geologists.................... 232
State Legislation.................... 3, 19
Steam Road Roller.................... 11
Steel Bridges.................... 197
Stone Crusher.................... 12
Sub-Grade.................... 117
Surface Betterment.................... 112
Sweden.................... 18
Switzerland.................... 18
Tables of Quantities, Weights and Measures.................... 422
Telford, Thomas.................... 10
Tennessee.................... 55, 83, 96, 107, 230, 274, 294, 346, 449, 455
Texas.................... 55, 83, 96, 107, 230, 275, 295, 346, 450, 455
Toll Roads.................... 7
Trade Names.................... 414
Treatises on Road Bridge and Culvert Construction.................... 318
Tresaguet, Pierre-Marie.................... 9
Types of Road.................... 110
Utah.................... 56, 84, 96, 108, 230, 275, 295, 346, 455
Vermont.................... 57, 84, 97, 108, 230, 275, 295, 346, 451, 455
Virginia.................... 57, 85, 97, 108, 231, 275, 295, 347, 451, 455
Vitrified Clay Culvert Pipe.................... 202
Washington.................... 58, 86, 97, 108, 231, 276, 295, 347, 452, 455
Washington Atlanta Highway.................... 4
West Virginia.................... 59, 87, 98, 108, 231, 277, 296, 347, 455
Wisconsin.................... 60, 88, 98, 108, 232, 277, 296, 347, 453, 455
Wyoming.................... 60, 88, 98, 109, 232, 279, 296, 348, 453, 455

ALPHABETICAL LIST OF ADVERTISERS

Page
Acme Road Machinery Co....... 138
Allentown Portland Cement Co., The,........................ 138
Alliance Clay Product Co., The. 140
Alpha Portland Cement Co..... 139
Alsen Cement.................. 140
American Highway Association 137
American Ingot Iron A.R.M. Co., Culverts.................. 194
American Sheet and Tin Plate Co.......................... 141
American Tar Co.............. 140
Ash Grove Lime and Portland Cement Co.................. 140
Austin-Western Road Machinery Co., The................ 143
Atlas Portland Cement Co., The......................... 142

Baker Co., The R. D........... 144
Barber Asphalt Paving Co., The.................. 145, 161
Barrett Manufacturing Co..... 147
Bausch and Lomb Optical Co.. 140
Bessemer Limestone Co........ 140
Better Roads and Streets (publication).................... 146
Big Four Clay Co., The........ 146
Birmingham Metal Products Co.......................... 196
Blanchard and Hubbard....... 146
Buffalo Steam Roller Co........ 148

Canada Cement Co............ 149
Canton Culvert Co., The....... 195
Carlyle Paving Brick, Co., The. 146
Cast Iron Pipe................. 193
Chicago Portland Cement Co... 148
Chicago Steel Tape Co......... 152
Clinton Paving Brick Co....... 146
Crescent Portland Cement Co. 152
Crosby, Walter Wilson......... 152

Deckman-Duty Brick Co., The. 152
Dixie Portland Cement Co..... 150
Dunn Wire-Cut-Lug Brick Co... 151

Egleston, Howard............. 152

Farquhar Co., Ltd., A. B....... 153
France Stone and Slag Co., The. 165

Page
Galion Iron Works and Manufacturing Co., The........... 154
German-American Portland Cement Works................. 146
Giant Portland Cement Co..... 153
Good Roads Machinery Co., Inc., The.................... 156
Gurley, W. and L. E........... 155

Haines and Teal, Inc.......... 173
Hartranft Cement Co., Inc., Wm. G...................... 170
Hassam Paving Co............ 155
Hastings Pavement Co., The... 158
Hocking Valley Brick Co....... 165
Holt Manufacturing Co., The.. 160
Howard, J. W................. 165
Huber Manufacturing Co., The. 161
Hunt and Co., Robert W....... 159
Hvass and Co., Chas.......... 159
Hydraulic Press-Brick Co...... 165

International Instrument Co... 165
Interocean Oil Co., The........ 184
Institute of Industrial Research, The........................ 137
International Harvester Co., of America, Inc................. 162
Iola Portland Cement Co., The 163

Jaeger Machine Co., The....... 164
Jennison-Wright Co., The...... 165

Koehring Machine Co.......... 166

Lehigh Portland Cement Co... 167
Luten Design................. 195

McAvoy Vitrified Brick Co., The........................ 169
Metropolitan Paving Brick Co.. 172
Michigan Bridge and Pipe Co.... 195
Michigan Portland Cement Co. 152
Milwaukee Concrete Mixer Co. 168
Munnsville Plow and Culvert Co.......................... 195

National Paving Brick Manufacturers Association......... 169

Page
Nelsonville Brick Co., The..... 172
Novelty Brick and Coal Co.... 172

Oklahoma Portland Cement Co. 170
Olsen Testing Machine Co., Tinius..................... 170
Oregonia Bridge Co., The...... 190
Orenstein-Arthur Koppel Co.... 179

Patton Clay Manufacturing Co. 172
Peerless Portland Cement Co.. 170
Pittsburgh Testing Laboratory. 171
Port Huron Engine and Thresher Co. 171
Portland Cement Co. of Utah.. 172
Portsmouth Culvert Co........ 196
Portage Silica Co., The........ 179

Randolph and Co., Isham...... 185
Rood-Maher Co., The.......... 191
Robeson Process Co........... 172
Robinson and Ross............ 185
Roche, Thos. M............... 185
Russell Grader Manufacturing Co......................... 174

Sandusky Portland Cement Co.. 174
Soisson Fire Brick Co., Jos.... 185
Southern Branch Petrolithic Co. 177
Southern Clay Manufacturing Co......................... 179
Spottiswoode-Cusack Co....... 179
Standard Asphalt and Rubber Co......................... 175
Standard Oil Co............... 176

Page
Standard Oil Co., of New York.. 178
Steel Protected Concrete Co... 179
Sterling Brick Co............. 185

Texas Co., The............... 180
Texas Portland Cement Co.... 163
Thornton Fire Brick Co., The. 190
Trumble Paving Brick Co., The. 190
Trussed Concrete Steel Co..... 181

Union Oil Co. of California.... 182
United Brick Co.............. 179
United States Asphalt Refining Co......................... 184
United States Cast Iron Pipe and Foundry Company....... 196
U. S. Wood Preserving Co..... 183
Universal Portland Cement Co.. 186
Universal Road Machinery Co.. 187

Virginia Portland Cement Co... 157
Vulcanite Portland Cement Co. 185

Wadsworth Stone and Paving Co., The..................... 188
Warren Brothers Co........... 189
Webster Brick Co., The........ 190
Westrumite Co., The.......... 190
Whitehall Cement Manufacturing Co...................... 192
Wolverine Portland Cement Co., The......................... 190

Zieg Manufacturing Co., The F. B............................ 196

IMPORTANT EVENTS IN THE ROAD MOVEMENT DURING 1913

Conventions and Congresses

International Road Congress.—The Third International Road Congress was held in London, England, June 23–28, 1913, and was participated in officially by the governments of practically all of the enlightened nations of the world except the United States. The Congress was held under the direction of the Permanent International Association of Road Congresses formed in Paris in 1908. The program was divided into two sections. The first section covered the general subjects of construction and maintenance and comprised papers and communications on the following subdivisions of these subjects: first question, "Planning of New Streets and Roads;" second question, "Types of Surfacing to Be Adopted on Bridges, Viaducts, etc.;" third question, "Construction of Macadamized Road Bound with Tarry, Bituminous or Asphaltic Materials;" fourth question, "Wood Paving;" first communication, "Improvements Adopted Since the Second Congress in Machinery Used in the Construction and Maintenance of Macadamized Roads;" second communication, "Tests of Materials Used in the Construction of Macadamized Roads;" third communication, "Construction of Water Bound Macadamized Roads;" fourth communication, "Technical and Economic Study of the Comparative Advantages of Different Types of Roads;" and fifth communication, "Various Types of Stone Paving in Use."

The second section covered the general subjects of traffic and administration and comprised papers and communications on subdivisions of these subjects as follows: sixth question, "Observations Noted Since 1908 as to the Various Causes of Wear and of Deterioration of Roadways;" seventh question, "Regulations for Fast and Slow Traffic on Roads;" eighth question, "Authorities in Charge of the Construction and Maintenance of Roads; Functions of Central Authorities and Local Authorities;" ninth question, "Finance of the Construction and Upkeep of Roads; Provision of Revenues;" communication six, "Direction and Distance Sign Posts;" seventh communication, "Development Since the Second Congress of Self-Propelled Public Service Vehicles;" eighth communication, "Qualifications of Engineers and Surveyors in Charge of the Construction and Maintenance of Roads; Wages and Conditions of Service of Foremen and Roadmen;" ninth communication, "Statisticea of Cost of Construction and maintenance;" and tenth communication, "Terminology Adopted or to Be Adopted in Each Country Relating to Road Construction and Maintenance."

American Road Congress.—The Third American Road Congress, under the management of the American Highway Association, the American Automobile Association and the Michigan State Good Roads Association, was held at Detroit, Michigan, September 29—October 4, 1913. The Congress was participated in by twenty eight organizations and had an attendance of over 3500. In connection with the Congress an exposition was held comprising exhibits by the United States government, several of the States and more than one hundred manufacturers. The program was divided into sessions as follows: National Legislation; Construction and Maintenance; Contract Work; State Legislation and Management; Finance; Economics; Traffic; Michigan Day. Hon. David F. Houston, secretary of agriculture, presented a paper carefully analyzing the question of "Federal Aid to Road Improvement." This subject was also dealt with by Hon. Dorsey W. Shackleford, chairman of the committee on roads, United States house of representatives, and by Hon. William P. Borland, member of congress. The government at Canada was represented by Hon. A. W. Campbell, deputy minister of railways and canals. The proceedings included papers by Hon. L. W. Page, director, United States Office of Public Roads; Secretary Doyle of the United States Civil Service Commission; State Highway Commissioners Sohier of Massachusetts, Carlisle of New York, Stevens of New Jersey, Wilson of Virginia, Buffum of Missouri, Terrell of Kentucky, Rogers of Michigan, State Highway Engineers Kellar of Alabama, Cooley of Minnesota, Hooker of New Hampshire, Foster of Pennsylvania, Hirst of Wisconsin, MacDonald of Iowa, Shirley of Maryland, Atkinson of Louisiana, Fletcher of California, McLean of Ontario and by former State Highway Commissioner MacDonald of Connecticut.

American Road Builders' Convention.—The Tenth Annual Convention of the American Road Builders' Association was held in Philadelphia, Pennsylvania, December 9–12, 1913. The attendance was estimated at about 3000 and a comprehensive exhibit participated in by more than one hundred manufacturers was held in connection with the Convention. The program was divided into sections as follows: Organization; Construction; Maintenance. Papers were presented by State Highway Commissioners Stevens of New Jersey, Rogers of Michigan, Carlisle of New York; State Superintendent of Highways, Hooker of New Hampshire; State Geologist Pratt of North Carolina, Chief Engineer Foster of Pennsylvania, Superintendent of Suburban Roads Grabill of the

District of Columbia; State Highway Engineers Cooley of Minnesota, Kingsley of Arkansas; Deputy State Highway Commissioner Hunter, of Pennsylvania Chief Engineer Dean of Massachusetts, Mr. Connell Chief of Bureau of Highways, Philadelphia, followed by discussion of these papers by many engineers and contractors.

Legislative Development

Federal Aid.—A standing committee on roads was established in the house of representatives in 1913 in the first session of the sixty-third congress, with Hon. Dorsey W. Shackleford, of Missouri as chairman. A bill presented by this committee in the second session of the sixty-third congress (H. R. 11686) was passed on February 10, 1914, by a vote of 284 to 42 and was referred in the senate to the committee on post offices and post roads on February 11, 1914. The bill authorized the secretary of agriculture to aid the States and civil subdivisions in the construction and maintenance of rural post roads in an amount not exceeding $25,000,000 in any fiscal year. Of this amount $65,000 is allotted to each State and the remainder, after deducting expenses of administration, is allotted to the States on the basis of population and mileage of rural post roads. Two methods of granting aid are provided in the bill under section 3 and 4, respectively. Section 3 provides for a coöperative arrangement between the secretary of agriculture and the State officials for the construction and maintenance of such roads as they may jointly agree upon, the work to be conducted under a joint arrangement, and the federal government and the States to each bear one-half of the cost. Section 4, generally known as the Shackleford Plan, classifies improved roads in class A, comprising macadam roads or their equivalent; class B comprising gravel or sand-clay roads or their equivalent; class C comprising graded and drained earth roads. For each mile of such roads federal aid is granted as follows: For class A $60 per mile, for class B $30 per mile and for class C $15 per mile, provided that the States shall put up an equal amount for expenditure during the succeeding year in construction and maintenance of the roads on which such reward has been paid by the federal government. The secretary of agriculture is authorized to make needful rules and regulations for the administration of the act.

State Legislation.—The States of Illinois and Iowa furnished the most striking development in State road legislation during the year 1913. In Illinois a long step toward centralizing the control of road construction and maintenance was made by the enactment of a law providing for a county superintendent in each county who is made by law a deputy of the State highway engineer. These superintendents have the power to veto all expenditures in excess of $200 in all townships and road districts. In Iowa the State highway commission is given general supervision over all county and townships officers charged with duties in connection with public highways. Other important legislation affecting roads was enacted, but these two are mentioned specifically because they indicate the trend toward State supervision and control of all highways within the State and not merely those upon which State funds are expended.

Among other developments during the year was the establishment of State highway commissions by Arkansas, North Dakota and Oregon.

Defeat of State Bond Issues

The defeat of the proposed $50,000,000 State bond issue for road improvement in Pennsylvania in 1913 was the third set back to the policy of State bond issues in the past three years. During 1912, a State bond issue of $50,000,000 for road construction was defeated in Ohio and a State bond issue of $10,000,000 was defeated in Colorado. In striking contrast to these defeats was the overwhelmingly favorable vote of the people of New York at the general election in November, 1912, for a State bond issue of $50,000,000 to continue the work begun by the first $50,000,000 bond issue authorized in 1905. The majority in favor of the second bond issue, was 356,000 as compared with the majority of 266,000 for the 1905 issue.

Important Projects

Government Inventory of Post Roads.—The comprehensive investigation begun in 1913 by the joint congressional committee on federal aid in the construction of post roads and completed in 1914, gives exact information on mileage and character of the roads on which rural free delivery routes are located. Briefly summarized, the investigation shows that the actual length of roads traversed by rural carriers is, in round figures, 1,003,000 miles; that of this length 61,500 miles consist of paved, crushed stone, slag and shell road; 128,600 miles of gravel and sand-clay road; 537,500 miles of improved earth road; 275,700 miles of unimproved earth road; 469,000 miles of road in bad condition part of the year, and 80,350 miles of road in bad condition all of the year. The investigation shows that the number of persons served on rural routes is 23,184,600.

Government Maintenance Object Lesson.—A project inaugurated by the American Highway Association has for its object coöperation between local authorities and the United States Office of Public Roads, in efficient maintenance of a highway leading from

Washington, D. C., to Atlanta, Georgia, a distance by the route selected of about 850 miles. The arrangement proposed is that the local authorities in each county expend such local funds as they have available for the portion of road in their respective counties under the direction of government highway engineers to be assigned to the work continously by the United States office of Public Roads and that the local authorities should further place the length of highway in their respective counties under the complete direction of these government engineers. The director of public roads has agreed to assign three engineers to this project for continuous service, and the American Highway Association has undertaken to make all the preliminary arrangements, conducting the negotiations between the government and the local authorities and provide an automobile for the use of each engineer for inspection purposes. Preliminary tours for completing arrangements were made in February, 1914, in which the State highway officials, of Virginia, North Carolina, South Carolina and Georgia participated with representatives of the government and of the American Highway Association.

Lincoln Highway.—The construction of a great hard surfaced highway from the Atlantic to the Pacific as a memorial to Abraham Lincoln, largely through private enterprise and private capital is a project of great magnitude launched by the Lincoln Highway Association in 1913. This Association has its headquarters in Detroit.

Revision of State Road Laws.—Under a coöperative arrangement, committees from the American Bar Association and the American Highway Association are acting in conjunction with the United States Office of Public Roads in a compilation of the laws of all of the States and as soon as this project is completed will take up the question of a revision of the laws looking to the obtainment of simplicity, efficiency and also of uniformity as far as practicable. The committees will make a progress report at the Fourth American Road Congress to be held in Atlanta, Georgia, in November, 1914

HISTORY OF ROAD BUILDING

Ancient Road Builders

When or where the first road was built is not known. Herodotus speaks of a great Egyptian road on which King Cheops employed 100,000 men for a period of ten years. According to the historian, this road was built of massive stone blocks 10 feet deep, and lined on both sides with temples, mausoleums, porticoes and statues. The streets of Babylon are said to have been paved as early as 2000 B.C., and several well surfaced roads radiated to neighboring cities. Carthage, before its fall, was the center of a highly developed road system. The ancient Peruvians had a wonderful system of national roads connecting all the principal parts of their empire.

Bridges were also built by the ancients at a very early date. The Euphrates, at Babylon, was crossed by a stone bridge prior to 2000 B.C., and it is known that the Chinese built bridges as public works as early as 2900 B.C.

The Romans as Road Builders

The first definite and fully authentic information concerning the systematic construction and maintenance of permanent roads comes to us from the Romans. It is generally understood that the Romans learned the art of road building from the Carthagenians. However, the construction of their first great road was as perfect as that of any of their later ones.

The first of the great Roman roads was from Rome to Capua, a distance of 142 Italian miles, and was begun by Appius Claudius, about 312 B.C. It was known as the Appian Way or "Queen of Roads." This road was later extended to Brundisium, a total of 360 miles, and was probably completed by Julius Cæsar. About 220 B.C. the Flaminian Way was built. It crossed the river Nar on a stone bridge which had a central span of 150 feet with a rise of 100 feet. When Rome reached the height of her glory, under the reign of Augustus, no less than 29 great military roads radiated from the city. These roads extended to every part of the vast empire and are estimated to have had a total length of 50,000 miles.

The Roman construction was in general extremely massive. The Appian Way is said to have been in good repair 800 years after it was built. On a carefully prepared earth subgrade was placed four successive courses or layers; the statumen or foundation course, the rudus or second course, the nucleus or third course, and the pavimentum or wearing surface. The top and bottom courses consisted in general of large flat stones, while the two intervening courses were built of smaller stone or other suitable material laid in lime mortar.

With the fall of the Roman Empire the roads were neglected and gradually fell into decay, so that today but little more than a trace remains of these splendid achievements.

The French as Road Builders

The Romans built and improved many roads throughout what is now France, but later these fell into decay. It was not until the beginning of the seventeenth century that interest in road building revived to any considerable extent. In 1661 Colbert was appointed comptroller of finance, and during his ministry 15,000 miles of hard road were built by means of enforced peasant labor under the old feudal institution of the corvee. The corvee prevailed with the utmost rigor until 1774, when Turgot abolished some of its most objectionable features. It was finally abolished in 1787.

The present road system of France was really founded by Napoleon. He adopted very largely the innovations instituted by Tresaguet, and perfected a splendid administrative system.

The most striking feature of the French road system is the skilled supervision provided in every grade of road work and in every unit of the administrative organization. The basis of the French system is the School of Roads and Bridges, one of the finest technical schools in the world, and maintained entirely at the expense of the National government. From the graduates of this school are chosen the highway engineers who are entrusted with the construction and maintenance of the roads of France.

The total mileage of all roads in France is about 355,000 miles. Of these 23,820 miles are classed as national roads and are, therefore, the property of the State. The remaining roads are divided into departmental and vincinal routes, for which the state only makes occasional appropriations for construction and which are invariably maintained by the local governments.

Toll Roads

The earliest mention we have of the exaction of tolls is probably that given by Strabo, on the roads leading from Babylon to Syria. It is not until 1346 that we find the toll system definitely adopted as a means of raising revenue for road maintenance and repair. In that year Edward III of England granted a commission to the Master of the Hospital of St. Giles and John Holborn to collect tolls on vehicles passing on the road leading from the Hospital of St. Giles to the Old Temple, London, and also on an adjoining road called the Portal. But it was not until the latter half of the eighteenth century and first part of the nineteenth century that this method of raising road revenues reached its greatest popularity. This took the form of a regular flood of turnpike acts passed by Parliament. It is estimated that in 1838 no less than 1100 turnpike trusts were in existence throughout the kingdom. The cost of collecting the tolls, however, often nearly equaled the income, leaving little or nothing for maintenance. In 1871 the census showed that 5000 persons in England and Scotland were engaged in merely collecting tolls. In 1857 Ireland freed herself from toll gates, and in 1878 Parliament passed an act abolishing tolls in England.

Tolls on vehicles were never popular in France and while introduced somewhat at different periods, never became general.

In the United States the first toll road was the Lancaster Pike, between Philadelphia and Lancaster, Pennsylvania, a distance of 62½ miles, the construction of which was authorized in 1792. Bridges were also constructed by private capital and tolls charged for crossing. The turnpike improvements continued to expand rapidly until in 1828 the length of chartered turnpikes in Pennsylvania amounted to 3110 miles, of which 2380 miles were completed at a cost of $8,431,059.50. It is stated that none of these roads had, up to that time, yielded sufficient dividends to remunerate their proprietors. By 1811 over 317 turnpikes had been chartered in New York and the New England States, having a combined length of 4500 miles and a capital of over $7,500,000. With the introduction of the railroad, interest in turnpike building practically ceased, and today there remain in the United States very few roads on which toll is collected on passing traffic.

The Cumberland Road.—Popular tradition generally attributes the conception of the National Road to Henry Clay. However, Albert Gallatin seems to have made the first definite suggestion of this road, while Henry Clay soon became its ablest champion.

By an act of Congress approved by President Jefferson on March 29, 1806, $30,000 was appropriated toward the survey and construction of a road leading from a point on the Potomac at or near Cumberland, Maryland, to the Ohio River at or near a point opposite the town of Steubenville. This act provided that the road be cleared to a width of four rods, and that no grade exceed five degrees. An act of Congress, May 15, 1820, provided $10,000 for laying out a road from Wheeling, Virginia, to the Mississippi

River near St. Louis. This was really to be a continuation of the Cumberland or National Road. The road was to be laid out 80 feet wide.

In 1835 arrangements were completed whereby the portion of the National Road between Cumberland and Wheeling was taken over by the respective States and operated as a toll road. Appropriations, however, were continued on the portion west of the Ohio River until May 25, 1838, when the last direct appropriation for construction was made. The total amount appropriated by Congress was $6,824,919.33.

The length of the line first opened was 130 miles and the cost of construction $1,700,000. The first stage coach bearing the United States mail from Cumberland to Wheeling passed over the road on August 1, 1818.

West of the Ohio, the road led through Columbus, Indianapolis and Terre Haute. The road was surfaced to Columbus, but west of that point it was only surfaced in places; and about 1850 most of the road was absorbed by local turnpike companies. Before the road was completed beyond the western boundary of the State of Indiana, the steam railway had become the chief agency of transportation and the National Road came to an end on the prairies of Illinois.

Great Road Builders

Tresaguet.—Pierre-Marie Tresaguet was born at Nevers, in 1716, died in Paris, 1796. While he was a great engineer and made many improvements for river navigation, posterity knows him only as a great road builder. Tresaguet may well be called the father of modern road building. In 1775, when MacAdam was but twenty-one years of age, Tresaguet presented a report to the Assembly of Bridges and Highways which amounted in reality to a treatise on road construction. The real value of Tresaguet's work was; first, in recognizing the need of constant maintenance and devising a means for carrying it out; second, improving the methods of construction and reducing the cost. The prevailing form of stone roads up to this time consisted of a transversely level stone pavement on which was placed broken stone to the depth of 12 inches at the sides and 18 inches at the middle. Tresaguet improved the drainage, gave a crown to the stone pavement or foundation, and reduced the depth of broken stone to a uniform thickness of 10 inches. The roads built by Tresaguet differ but little from those built by Telford in Scotland some thirty years later. While Tresaguet was not fortunate enough to leave his name to the type of road he advocated and built, he laid the foundation upon which it was possible for Napoleon to build the great system of French highways. Tresaguet laid especial emphasis on organized, continuous maintenance. He first began the organization of cantonniers, which are the very backbone of the present French system of road maintenance.

John Loudon MacAdam.—John Loudon MacAdam was born at Ayr, Scotland, September 21, 1756, and died November 26, 1836.

While MacAdam was not the inventor of the road which now bears his name, he nevertheless deserves great credit for the work he did. The broken stone road as adopted by MacAdam was used in practically the same form in several parts of Europe, though he was no doubt the first to grasp and fully explain the theory of the broken stone road without a paved foundation.

MacAdam demonstrated that stone when broken to the proper size and placed on a properly drained and graded earth foundation would so consolidate under traffic as to be thoroughly waterproof and capable of carrying the heaviest vehicles without injury. He held that the earth, in fact, sustained the load, and all that was necessary was to thoroughly drain the roadbed and protect the surface with an impervious covering.

At the death of his father in 1770, young MacAdam went to live with his uncle, a merchant in New York City. In 1783 he returned to Scotland and was shortly appointed as deputy-lieutenant for the county of Ayreshire. In performing his duties as magistrate and trustee of roads, MacAdam became impressed with the lack of scientific principles in the construction and maintenance of the roads. In 1816, he became inspector for the Bristol "Turnpike Trust" and supervised the reconstruction and repair of 178 miles of roads. In 1817 he built the first macadam roads in London, the approaches to Blackfriars and Westminster bridges. In 1823 MacAdam moved to London, where he was appointed street commissioner in 1817. Slowly the system of construction and maintenance which he advocated spread throughout the entire empire. In 1836 he returned to Scotland where he owned a house in the little town of Moffat: but he was not long permitted to enjoy his leisure, for he died the same year.

His principal writings are: *A Practical Essay on the Scientific Repair and Preservation of Public Roads*, London, 1819, and, *Remarks on Present State of Road Making*, London, 1820.

Thomas Telford.—Thomas Telford was born in Dumfriesshire, Scotland, August 9, 1757, and died September 2, 1834, and was buried in Westminster Abbey.

Thomas Telford was one of the greatest civil engineers of his time. He was one of the founders of the "Institution of Civil Engineers" and was annually elected as its president until his death. His works were recognized both at home and abroad. For the Austrian government, he built the road from Warsaw, to

Brest, while the King of Sweden conferred the order of knighthood of "Gustavus Vasa" in recognition of his services on the Gotha Canal. As some of his most notable achievements may be mentioned the following bridges: Across the Tay at Dunkeld, the Menai Straits, the Conway bridge, the Deanbridge at Edinburgh, and the Broomielaw bridge at Glasgow. Canals: Ellesmere, Caledonian, Gloucester and Berkeley, Grand Trunk, Macclesfield, Birmingham and Liverpool Junction, and the Gotha. Harbors: Pulteneytown, Aberdeen, Dundee, Dover, and the St. Katherine docks at London.

In 1803 he was appointed engineer for the construction of 920 miles of roads in the highlands of Scotland. Later, he perfected the road communication between London and Scotland and the northern towns of England. An undertaking of equal magnitude and importance with that in the highlands of Scotland was a system of roads through the more inaccessible parts of Wales.

The form of construction most generally used by Telford, and which bears his name, is very similar to that employed much earlier by Tresaguet. The foundation course on which is placed the broken stone consists of stones about 10 inches by 6 inches by 4 inches, in dimension, carefully placed by hand and keyed firmly with smaller chips. Care is taken to secure the best possible drainage. At the present time, the Telford system is more commonly employed abroad than in this country. American road builders usually only resort to the Telford system when the natural earth foundation is weak. The chief objection is generally stated as being the high first cost due to the large amount of hand labor required.

Principal Inventions

The Steam Road Roller.—The steam road roller was invented by M. Louis Lemoine, of Bordeaux, France, and a patent was granted to him by the French government in 1859. M. Lemoine's roller was first used on the road in the Bois de Boulogne in 1860. The first English patent was granted to Messrs. Clark and Batho in 1863. About 1864 a roller built under this patent was shipped to Calcutta, where it was used with great success.

The first steam roller used in England was on the roads in Hyde Park in 1866. In September 1867, the borough authorities of Liverpool purchased from Messrs. Aveling and Porter their first steam road roller, which weighed 30 tons.

The first steam roller used in the United States was imported from England in the fall of 1868. This roller was first used in the United States Arsenal grounds, Philadelphia, Pennsylvania. At the present time, the term "steam roller" is somewhat of a mismomer, as the recent developments in oil and gasoline engines have made this form of motive power practical.

The Stone Crusher.—The stone crusher was invented in 1858, by Mr. Eli Whitney Blake, of New Haven, Connecticut. Mr. Blake's crusher was used for the first time in Central Park in crushing stone for concrete. In 1859 the city of Hartford, Connecticut, purchased one of these crushers for use in the improvement of its streets and roads. This is the first application of mechanical power in the preparation of road metal.

Mr. Eli Whitney Blake was born in Westboro, Massachusetts, on the 17th of January, 1795. He was a nephew of Eli Whitney, the inventor of the cotton gin. In 1816 he graduated from Yale. For a time he studied law, but soon entered the manufacturing business. He died in 1886.

ROAD SYSTEMS OF FOREIGN COUNTRIES

Austria-Hungary

The roads in Austria-Hungary are divided into four administrative classes, namely; government roads, provincial roads (designated county roads in Hungary), district roads, and town roads (designated parish roads in Hungary). The government roads, of which there are 10,008 miles in Austria and 5600 in Hungary, are constructed and maintained at the expense of the imperial government, which has complete supervision over construction and maintenance. The provincial roads in Austria, of which there are 2288 miles, and county roads in Hungary, of which there are 17,400 miles, are constructed and maintained at the expense of the province or county, the imperial government contributing in some cases. The district roads, of which there are 39,212 miles in Austria and 8100 miles in Hungary, are constructed and maintained by the districts, except that very poor districts are aided by the province or the county. The town roads, of which there are 22,756 miles in Austria, and the parish roads, of which there are 700 miles in Hungary, are local roads and are paid for by the town or parish, the province or county occasionally aiding by grants. The total mileage of all roads in Austria was 74,265 miles in 1909, and in Hungary 31,800 miles in 1910. The average cost of maintenance in Austria is given at about $311 per mile per annum, and in Hungary $282, exclusive of bridges. In both Austria and Hungary the general government has general supervision over all roads. In Austria the road administration is under the ministry of the Interior, under which there are district engineers, each in charge of 74½ miles of road. Under each of the district engineers are three road masters,each having about 24.9 miles of road, and these in turn supervise the actual road workers or patrolmen, each of whom has about 2.9 miles of road to maintain. There are in all about 4000 men employed on the Austrian government roads. The Hungarian road system is similar and employs about 2500 men.

Denmark

The roads of Denmark are divided into main roads, of which there were 4213 miles in 1910, and local roads, of which there were 22,505 miles in 1910, or a total of 26,718 miles. The main roads are maintained at the expense of the counties, of which there are twenty-one in the kingdom, and the local roads are maintained at the expense of the parishes, which are sub-divisions of the counties. There is a general superintendent of highways who has supervision over all the highways in the kingdom. The direct supervision, however, is by the counties for main roads, and by parishes for local roads. The government does not grant money aid. The principal roads in the kingdom are maintained by a patrol system, under which each patrolman has charge of about 2½ miles of road. The cost of construction varies widely, ranging from about $1300 to about $8700 per mile, the character of construction being usually either gravel or macadam.

England and Wales

There were in 1909–10 a total of 150,908 miles of roads. The roads are divided into main roads and roads other than main roads, the mileage in 1909–10 being respectively 27,826 miles and 123,082 miles. The general government renders aid to road construction and maintenance in three ways; first, through the assignment of certain national revenues, varying in amount, to the aid of local taxation, it being optional with the local authorities as to how much of this fund is spent on roads; second, by loans through the government road board; third, by free grants through the government road board. The government does not supervise the work where it is done with current revenues, but where it is under loan or grant, the sanction of the road board must be obtained and this is generally based on plans and estimates. The assistance granted by the government through loans and grants is for the construction and maintenance of new roads or the road board itself may construct and maintain new roads. The annual cost of maintenance of main roads is given for 1909-10 as $389 per mile per annum. and the roads other than main roads $112 per mile per annum. The amount expended by local authorities in 1909-10 was $32,498,000, not including loans, which amounted to $7,916,964.

France

The roads of France aggregate 520,088 miles and are divided into the following classes: national roads 23,754 miles; department roads 9050 miles; vicinal roads, sub-divided into roads of through travel 107,065 miles, and roads of common interest 47,263 miles (the roads of these two latter classes traversing several communes or towns), ordinary vicinal, which are located within a single commune, 177,580 miles; rural roads, which are unimportant neighborhood roads 155,376 miles. It is estimated that the national roads cost $9000 per mile for construction and $346 per annum for maintenance; the department roads $7400 per mile for construction and $189 per annum for maintenance; the vicinal roads of through travel $4500 per mile for construction and $125 per annum for maintenance; the vicinal roads of common interest $3000 per mile for construction and $95 per annum for maintenance; the ordinary vicinal roads $2000 per mile for construction and $63 per annum for maintenance. The national roads are constructed and maintained entirely at the expense of the national government, which also aids by subsidies to a small extent, the vicinal roads. The departments maintain the department roads. The national government has general jurisdiction over all transportation facilities and direct supervision over the national roads, which are administered by the corps of bridges and roads in the ministry of public works. The corps of bridges and roads is divided into three divisions, of which roads and navigation form one.

The division of roads and navigation is under the direction of a counselor of state and is divided into two sections, namely; bridges and roads, and navigation. The section of bridges and roads is divided into two bureaus, one of which has entire charge of the national roads, and the other has jurisdiction over all matters relating to department roads, automobile traffic and general police regulation. The sections and bureaus and the higher field inspection are under the direction of inspectors general. Each of the inspectors general of the second class have charge of a large field division and under him engineers in chief, usually one to each department, while under these engineers in chief are ordinary engineers and under them are sub-engineers and conductors or foremen and finally the patrolmen who work directly and constantly on maintenance, each having a section of road varying in length, but averaging about 2.8 miles. There were 8560 patrolmen employed in 1909 on the national roads. The engineers for the French road service are trained in the School of Roads and Bridges at Paris and are appointed upon graduation to the lower positions and gradually advanced to positions of responsibility.

The annual expenditure on the public roads of France is about $48,000,000. The national government appropriated in 1910, $9,720,000 for the national roads. It is estimated that the total cost of the entire French road system, excluding the unimportant neighborhood roads, is upwards of $1,100,000,000.

Germany

The imperial govermnent of the German Empire takes no part in the construction or maintenance of public roads. Each state in the Empire follows its own policy in this matter.

As a general rule the roads in the various states are divided into three classes: state or provincial roads; county roads, and local roads. The state roads are generally built and maintained by the state, which maintains a corps of competent engineers. The larger states usually divide their road systems into districts, the engineers in charge of the districts reporting directly to the central office. The patrol system is quite generally followed, each patrolman having from 2 to 5 miles of road to maintain. Their compensation is from $150 to $250 per annum. At the end of thirty years service, or if sooner incapacitated, they are entitled to a pension.

Prussia takes no direct part, however, in the maintenance of roads. The state roads were turned over to the provinces in 1875 and some of the provinces in turn passed them on to the counties. The general government grants aid to the provinces by certain allowances fron the "dotation fund."

The largest class of improved roads in the German Empire is that of the county roads which are very largely maintained by local taxation. The states and provinces, however, exercise close supervision over these roads. The parish roads are purely local and are maintained and managed by the parishes, although occasionally the county and even the province aid in new construction.

There are approximately 36,000 miles of state road in Germany, of which Prussia has 20,489 miles, Bavaria 4200 miles, Saxony 2267 miles, Baden 1890 miles, Wurtembourg 1710 miles, and the smaller states the remainder. Of county roads Prussia has 38,400 miles hard surfaced, parish roads 14,598 miles hard surfaced, and private roads 1100 miles hard surfaced, or a total of 74,587 miles of improved roads, or 1 mile for each 1.8 square mile of area. Prussia expends nearly $35,000,000 a year on all roads, of which about 28 per cent is paid by the provinces, 33 per cent by the counties and 39 per cent by the parishes. Under favorable conditions the cost of construction of state roads does not often exceed $5000 per mile. In Hanover a considerable mileage of brick roads has been constructed at from $10,000 to $13,000 per mile. In the kingdom of Wurtemburg the cost of maintenance of state roads in 1910 was $400 per mile.

Italy

The roads of Italy aggregated 92,199 miles in 1910, and were divided into three classes, namely, national roads, connecting important cities and ports; connecting with roads of other countries; the Alpine and Appennine roads, and those used for military purposes, having a total mileage in 1910 of 5159 miles; the provincial roads, connecting the chief town of each province with the chief towns of other provinces and with maritime ports, having a total of 27,757 miles; communal roads, which are the roads of local interest, having a mileage of 59,283 miles. The national roads are constructed and maintained by the national government through the department of public works. The official in charge is designated as the director general of bridges and roads. The provincial roads are constructed and maintained by the provinces, while the communes or townships provide for the construction and maintenance of communal roads. The national roads are maintained by means of the patrol system, each patrolman having an average of 2½ miles of road. It is estimated that the cost of maintenance in 1909-10 was $274.70 per mile per annum for national roads, and $183.32 per mile per annum for provincial roads.

Norway

The roads of Norway aggregate 17,550 miles and consist of main roads, 6570 miles, and district roads, 10,980 miles. The national government contributes two-thirds to three-quarters of the cost of construction of main roads, while the maintenance of such roads is, with few exceptions, a local burden. The work is done under county engineers who are nominated by county councils and appointed by the national government. At the head of the whole system, however, is the national road director. It is estimated that the main roads cost about $8000 per mile.

Russia

There are 11,254 miles of post roads in Russia, of which 8326 miles are under direct government control and 2928 miles are temporarily under control of district councils with government supervision. The construction and maintenance of these government roads are partly under the ministry of ways and communications, and partly under the war department. It is estimated that the cost of construction of government roads is from $8544 to $10,874 per mile, and the maintenance from $70 to $210 per mile per annum.

Spain

There were 33,873 miles of road in Spain, in 1910, which were classified as state roads and provincial roads. State roads are constructed and maintained by the general government through the department of public works. Under this department is a director general, and under him a chief engineer for each province. The government also aids, by appropriations, maintenance of provincial roads. The patrol system is followed in the maintenance of state roads. It is estimated that the maintenance of state roads costs between $230 and $240 per mile per annum.

Sweden

There were 35,450 miles of road in Sweden, in 1907, made up of 11,850 miles of main roads and 23,600 miles of district roads. The main roads are those which unite the kingdom with other countries and connect the large cities and ports. The district roads are those of local importance. For the construction of main highways, the government pays two-thirds and the districts one-third of the cost, while on maintenance of these roads, the government pays 15 per cent of the total. The royal board of road building and water works has supervisory powers in road, railroad and harbor construction. The expenditure per mile of road, including all classes, was in 1907, $60 per mile.

Switzerland

There were in 1911, 7426 miles of road in Switzerland which were classified as federal aid canton roads built and maintained by the cantons with federal aid, 350 miles; canton roads, built and maintained by cantons, 862 miles; municipal roads built and maintained by municipalities 6214 miles. The federal government grants aid only to those four cantons whose roads are of international character, the annual aid being as follows: Uri, $15,440; Graubenden ,$38,600; Tessin, $38,600; Valais, $9650.

The department of public works in each canton supervises road construction and maintenance, while the upper supervision of the federal government is carried on through the department of the interior. Construction of roads in Switzerland is very expensive on account of the fact that they are practically all mountain roads.

STATE AID LEGISLATION

Revised to January 1, 1914[1]

ALABAMA

The State highway commission consists of a professor of civil engineering in the Alabama Polytechnic Institute, the State geologist, and three civilians appointed by the governor, who hold office for four years. The commission deals with matters of general policy and acts for the highway department in making recommendations to the governor and in all dealings which the highway department may have with the governor and the legislature.

A State highway engineer is chosen by the commission and holds office at their pleasure and he is required to be a competent engineer experienced in road building. He is required to make a general highway plan of the State, collect information, determine the character and supervise the construction of roads built through the aid of the State, and he is further required to prepare a map showing such of the main highways in the State as in his judgment are of sufficient importance to be designated as State roads and which should be improved and maintained at the cost of the State in coöperation with the counties.

A cash appropriation is made and apportioned equally to all the counties in the State on condition that the counties provide an equal amount. Any county desiring such aid shall make a written application to the State highway commission and power is given the State highway engineer to approve or disapprove this application. The preparation of plans and specifications and the actual construction of the road selected are under the direct control of the State highway engineer, who is also authorized to thereafter require that such roads be kept in proper repair, and if the county fails to carry out the recommendations of the State highway engineer in the maintenance of such road, the State highway commission may prescribe rules under which the work may be done by the State and the expense paid by the county, or if the county defaults, the payment shall be made out of any money due the county from the State aid fund.

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[1] In the preparation of this digest much information has been obtained from the publications issued by the Joint Congressional Committee on Federal Aid in the Construction of Post Roads.

The appropriation for the last fiscal year was $154,000 less the expense of operating the State highway department, or an average of about $2000 per county. (Approved by W. S. Keller, State highway engineer.)

ARIZONA

The State engineer is appointed by the governor by and with the advice and consent of the senate, and is required to be a competent civil engineer. He prepares plans and specifications for State highways and bridges and all State highway work is done under his supervision. He is also required to aid the county superintendents of roads by giving them advice (office of county road superintendent and county surveyor, abolished January 1, 1915—see county road laws).

For construction purposes an annual running appropriation of $250,000 is made. Seventy-five per cent of this appropriation is to be expended in the counties in which raised under the direction of the county boards of supervisors and the State engineer; 25 per cent to be expended under the direction of the State board of control (the governor, auditor and citizen member, appointed by the governor), and the State engineer. All engineering expenses to be paid out of the 25 per cent portion. (Approved by Lamar Cobb, State engineer.)

ARKANSAS

An act approved March 31, 1913, provided for forming the State land office into a department of State lands, highways, and improvements, and created in connection with it a State highway commission and a highway improvement fund. The State highway commission is to consist of five members, as follows: Commissioner of State lands, highways, and improvements, chairman; two members to be appointed by the governor to serve, respectively, one and two years; thereafter, as the terms expire, each commissioner appointed shall serve two years. The existence of the State highway commission is limited to thirty years.

The commissioner of State lands, highways, and improvements is required to appoint a State highway engineer subject to the approval of the commission, who shall be a graduate in engineering of some reputable school of engineering and skilled in road building. He holds office for the term of two years.

A highway improvement fund is created, composed of funds derived from motor-vehicle fees and licenses being one-half the total $10 fee or $5 per vehicle.

The department is required to collect data, see that road laws are enforced, hold road institutes at least once a year, which county judges, county engineers, and road overseers are required to attend, and for which they are to receive the same pay as if they were engaged in actual road work. The department is required to furnish plans and specifications when required to do so, and aid in the formation and management of highway improvement districts. The department is authorized to determine the method of distribution of any State road funds that may be available.

The highway improvement districts are created on application to the county courts, giving description of the roads to be improved and the territory traversed by them. The county court, in the approval of any highway improvement district charter, shall give to the department of State lands, highways, and improvements such specific supervision and control over the highways in question as may be proper and convenient for improvements contemplated in the charter. These applications are forwarded to the department of State lands, highways, and improvements, with recommendations by the county judge. The State highway commission then selects the routes to be taken by such highways and provides for laying off the improvement district to be especially taxed for such improvements, and prepares and issues a charter to the district. The State highway commission assesses the benefits upon the property within the district.

The department is authorized to employ State convicts on the public roads or for public road purposes. (Approved by E. A. Kingsley, State highway engineer.)

CALIFORNIA

The State department of engineering consists of the governor who is exofficio chairman; State engineer, who is the chief executive officer; the general superintendent of State hospitals; the chairman of the State board of harbor commissioners at San Francisco; and three members appointed by the governor. The department has, in addition to its other duties, authority over State highways and all participation by the State in works of highway improvement. It is also authorized to make such investigations as are deemed desirable.

By resolution, the department of engineering designated the appointed members of the department as a commission to be known as the California Highway Commission. The resolution gave the commission full authority over the construction of the system of State highways under the $18,000,000 State bond issue, and to perfect such organization as should be necessary to carry on such work. A highway engineer appointed by the governor is the executive officer of the commission and has charge of the construction of the system of State highways under the $18,000,000 bond issue.

The legislature of 1909 passed an act which was ratified in the November election in 1910, authorizing the issue of $18,000,000 in State bonds for the acquirement and construction of State highways running north and south, traversing the Sacramento and San Joaquin Valleys and along the Pacific coast, and connecting the county seats lying east and west of such highways. This system of highways is to be constructed and maintained at the expense of the State, except that each county must pay into the treasury 4 per cent per annum upon the sum of money expended in such county in the construction of said State highways, less such portion of the amount expended as the bonds matured shall bear to the total number of bonds outstanding.

In addition to the system of State highways, special appropriations are made from time to time for the construction of State roads in mountainous country and in localities too poor to pay for their construction and upkeep. (Approved by A. B. Fletcher, State highway engineer.)

COLORADO

The State highway commission consists of a highway commissioner, appointed by the governor, and an advisory board of five members, holding office from one to five years, respectively. The commission is required to meet four times a year and to appoint a secretary, who is required to be a civil engineer and a practical road builder, to hold office at the pleasure of the commission. The commission is required to prepare a map showing the public roads in each county connecting the roads of sufficient importance to receive State aid and form a connecting system of State roads. The commission is given authority to designate the most important roads as the first to be improved. They are also authorized to make investigations to ascertain the location of road material, etc. The commission is given authority to apportion the State road fund among the counties, taking into consideration area, amount of money expended in construction, difficulty and extent of such construction, and extraordinary expenses in connection with the development of new territory. The counties receiving such aid are required to raise an amount equal to the amount set aside by the State, unless the State highway commission should desire to extend further aid to poorer counties, in which case they may extend it to the extent of $5 of State money to $1 of the county's. All money apportioned to counties and not accepted by them is distributed to other counties. The county commissioners are to designate the roads to receive State aid, subject to the approval of the State highway commissioner. The county commissioners must make surveys, prepare plans and specifications, and make estimates and submit them to the State highway commissioner for approval. Contracts are let by the county commissioners after approval by the State highway commissioner. Construction and maintenance are under the supervision of the county commissioners, subject to the approval of the State highway commissioner. The money apportioned by the State highway commission shall be paid to the treasurer of the county on estimates from the State highway commissioner as the work progresses. Annual reports must be made by the county commissioners to the State highway commissioner of all moneys expended on roads during the current year.

All moneys accruing from forest reservations in the State under act of Congress approved May 23, 1908, shall be apportioned to the counties in which the reservations are situated in proportion to the area of such reservations in the respective counties. No less than 5 per cent of such fund shall be expended for either roads or schools, in the discretion of the board. Appropriations for State highways are made directly by the legislature.

An act of the legislature passed in 1913 providing that the county commissioners in counties having a revenue of $12,000 or more may elect a county road supervisor to have entire supervision of all the roads and bridges in the county. He is required to make a complete report on the first of each month, which report after approval by the county commissioners is forwarded to the State highway commissioner. He is required to attend at least one meeting annually at the capitol called by the State highway commissioner. His other duties are explained in the chapter on "Local Road Legislation." (Approved by J. E. Maloney, secretary, State highway commission.)

CONNECTICUT

A State highway commissioner, who shall be a capable road builder, is appointed by the governor with the consent of the senate and holds office for four years. He has a right to enter any town in the State and lay out and improve any trunk-line roads and certify the cost of the same to the State comptroller for payment. He has authority to approve the application of the selectmen of any town for State aid, to select the highway to be improved with such aid, make surveys, plans and specifications therefor, determine the character of the road, and have supervision of the construction. He has the right to reject any and all bids, and where the cost is less than $1000 he may at his discretion, permit the town to do the work. He shall keep all State roads in repair and certify the cost to the comptroller. He is authorized to appoint a deputy commissioner, eight division engineers, and such other assistants as he may deem necessary, and fix their salaries.

Whenever any town desires to improve a public road by the aid of the State the selectmen of the town shall make application to the State highway commissioner for such aid, such application to be subject to his approval. The aid granted by the State is apportioned as follows: In towns having a taxable valuation of over $1,250,000 the State pays three-fourths of the cost of roads constructed as State aid roads, and in towns having a valuation of $1,250,000 or less the State pays seven-eights of the cost of such construction, the whole amount to be paid by the State in any one year being $500,000. The sum so expended shall not exceed $10,000 per town in any one year. The law permits the use of two years appropriation in one year. A trunk line system, comprising the principal roads of the State laid out and amended by the legislature of 1913 is gradually being constructed and maintained entirely at the cost of the State, provided the total amount expended for such trunk line to September 30, 1915 shall not exceed $2,000,000 under the new appropriation. The State highway commissioner is authorized to lay out, widen and grade any highway in the State whenever he deems it necessary for the purpose of connecting with the trunk line highways. Under the new law, towns are permitted to improve State aid roads with their own funds and recover their proportion of the cost of said improvement under a subsequent appropriation by the State. Said work must be done under the supervision of the State highway department and must not exceed an amount designated by said department.

The maintenance of trunk-line roads is paid for entirely by the State, while the maintenance of State roads other than those on the trunk lines is borne by the State and town in the ratio of three-fourths and one-fourth respectively. All moneys received by the State from automobile licenses and fines, amounting at present to about $350,000 are for road maintenance. The State issues State bonds for building of State highways, and the law of 1913 provides for the issuance of said bonds for this purpose. Additional appropriations are made, as necessary, for maintenance.

There is an appropriation of $1,000,000 for the two years ending September 30, 1915, for the improvement of State aid roads. Of this $1,000,000, the towns in which work is done, are obliged to contribute either one-quarter or one-eighth of this amount. (Approved by Charles A. Bennett, State highway commissioner.)

DELAWARE

There are three counties in the State one of which, New Castle County, has a State highway commissioner for the county, appointed by the governor. As the duties of the commissioner relate only to the one county further information is given in a chapter on "Local Road Legislation."

DISTRICT OF COLUMBIA

The commissioners forward to congress, through the secretary of the treasury, estimates of proposed expenditures for each fiscal year ending June 30. To the extent to which these estimates are approved, inasmuch as the National government owns fully one-half in value of the property in the District, congress appropriates 50 per cent, and a like proportion is paid from the District revenues. (Approved by Mark Brook, captain, Corps of Engineers, U.S.A. assistant to engineer commissioner, D. C.)

FLORIDA

The State government has no highway department and does not grant aid to road construction.

GEORGIA

Georgia has no State highway department and grants no State aid in the form of money. All male felony convicts are apportioned to the several counties for work on the public roads, the apportionment being on the basis of population. This aid is under the supervision of the State prison commission, which is authorized to purchase road machinery, appliances, and teams and equip and organize such convicts in road forces. (Approved up Dr. S. W. McCallie, State geologist.)

IDAHO

The present State highway department was created by the 1913 legislature and consists of a State highway commission of five members including ex-officio, the State engineer, secretary of state, and the professor of civil engineering of the State University, and two civilian members appointed by the governor. The engineering department is under the direction of a State highway engineer appointed by the commission. The legislature authorized a State bond issue of $200,000 to aid in the construction of proposed State roads on the plan of the State bearing one-third of the cost of construction and the county two-thirds. The location, surveys estimates, etc., are made at the expense of the State and the roads are built under the supervision of the State highway engineer under contracts which are let by the State highway commission. After completion all roads of this kind are maintained at the expense of the State. (Approved by Edward S. Smith, State highway engineer.)

ILLINOIS

Under the road and bridge Law, approved June 27, 1913, a State highway commission of three members was appointed by the

Governor, one for two years; one for four years, and one for six years; and thereafter one every two years. A chief State highway engineer and an assistant State highway engineer are also appointed by the governor, each to serve for six years and until their successors are appointed and qualified. All are appointed with the approval of the State senate.

The state appropriated $400,000, 1913–1914, and $700,000, 1914–1915, for State aid roads. An equal amount must be raised by the various counties in order to make these appropriations available. Also in addition $100,000 per annum for engineering and experimental work.

Counties in order to meet allotments made to them by the State highway commission may raise money to meet their proportion by special tax, or by issuing bonds if there is not enough money in the county treasury to meet them by direct appropriation.

State aid roads and bridges are constructed at an expense of one-half paid by the county and one-half by the State, but the State will forever maintain roads so built under the direction of the State highway commission.

Provisions are made for construction of highways and bridges on county lines other than state aid roads by joint action of the counties. Also for construction by joint action of the counties and townships interested. (Approved by P. C. McArdle, assistant State highway engineer.)

INDIANA

The State has no highway department and does not grant aid in any form toward road construction and maintenance.

IOWA

By the act of the thirty-fifth general assembly, a State highway commission was created in Iowa with much more power than the former commission. Two members of the commission, J. W. Holden, and H. C. Beard, are appointed by the governor from opposite political parties. A. Marston, Dean of Engineering at the Iowa State College is ex-officio the third member of the commission.

These commissioners have organized their engineering force, under Thos. H. MacDonald, highway engineer, working in four departments: designing, field, office, and educational. The designing department is under the direction of C. B. McCullough; the field department is in charge of F. R. White; the office department is managed by J. H. Ames; and the educational department is directed by J. S. Dodds. The field work of the commission is in immediate charge of five division engineers who cover the whole State and report to the field engineer.

The highway commission is charged with the supervision of the road and bridge work of the State. This work is in direct charge of the county and township officers assisted by the county highway engineer. The township officers have charge of construction and maintenance of the township road system which embraces about 85 per cent of the mileage of the county. The county officers build all bridges and culverts and have charge of the county road system made up of those roads not in the township system. The county system, made up of those roads which connect the trading points and the adjoining county systems but not to exceed 15 per cent of the entire mileage of any county are the main traveled roads and constitute a complete network of roads threading throughout the State without a break.

All bridge and culvert work must comply with the highway commission standards. Contracts for single structures costing over $2000 must be approved by the highway commission. All plans for permanent road grading, drainage, and surfacing must be approved by the commission. Standard plans and profiles are made for each mile of road so improved.

An excellent feature of the law is the resolution of necessity required to be published to inform the public of the intention to build structures costing over $300. This resolution must describe the location of proposed structure, dimensions, drainage area, material of construction, and estimated cost of all contemplated work.

KANSAS

The State grants no money aid for road improvement, but the office of State engineer has been established at the agricultural college for the purpose of giving advice throughout the State in connection with the construction and maintenance of roads and bridges, drainage, and irrigation. The appropriation is about $9,000 per annum. (Approved by W. S. Gearhart, State engineer.)

KENTUCKY

By an act passed in March, 1912, the governor was required to appoint on July 1, 1912, and every four years thereafter a State commissioner of public roads who, shall be a graduate in civil engineering from some reputable university or some technical college and have had at least five years' experience in civil engineering. The expenditures chargeable to the State road fund were limited to not to exceed $25,000 per annum. The commissioner is authorized to collect and disseminate information, furnish plans, specifications, and estimates of cost of bridges and roads, but it is not obligatory on the part of local officials to accept such plans and specifications, but they must be kept on file in the office of the county road engineer, as are the plans, specifications, and actual cost. He is also required to hold an examination for the appointment of county engineers, and such county engineers shall, upon order of the State commissioner, cause all roads within their counties to be measured and shall make report to the said commissioner.

The law does not give any money aid to the counties, nor does it give the State commissioner of roads supervision or control of any road work in the State. (Approved by Robert W. Terrell, State highway commissioner.)

LOUISIANA

The board of State engineers is authorized to appoint a State highway engineer, who holds office until removed for cause by the board. He is required to be a competent civil engineer, experienced in highway work. The board is authorized to appoint assistants and clerks and provide offices; to hold meetings in its discretion for considering the general policy of the department and receive the annual report of the State highway engineer. The board acts in all matters concerning recommendations, estimates, etc., to be submitted to the governor.

The State highway engineer is required to make a general highway plan of the State, collect statistics, establish standards for construction and maintenance, have supervision over construction and maintenance of State highways on which State aid has been granted, subject to the approval of the board of State engineers. He or his assistants must make all surveys, plans, specifications, and estimates and select material for such State highways. He awards contracts, but may reject any and all bids and conduct the work with his own force. He is authorized, with the approval of the board of State engineers, to purchase, for the State, road machinery, draft animals, and supplies, and loan such equipment to the parishes. Upon completion of contract for State highways the State highway engineer certifies to the State treasurer and the president of the police jury the portion to be paid by the State and parish respectively.

The State highway engineer is required to keep all roads improved as State highways in repair, the total cost to be paid by the State and the parish to reimburse the State in the same manner as for construction. He is required to organize a system of repair whereby all roads may be in good condition at all times.

The initiative in obtaining State aid rests with the police juries of the respective parishes. They make application to the State highway engineer for State aid in the improvement of main traveled roads, and the said State highway engineer must take up such applications as far as practicable in the order of their receipt, provided the parishes have raised their portion of the cost of such improvement.

In order to provide a State aid fund all surplus revenues received by the oyster commission and the game commission and from any State vehicle tax and from a general property tax of one-fourth of 1 mill, are placed in a fund known as the State highway fund. This fund is apportioned by the State highway engineer with the approval of the board of State engineers.

The State engineer may, with the approval of the board of State engineers, use convicts for highway work, the labor to be furnished free of charge, and the cost of maintenance and operation to be borne by the parishes or districts. (Approved by W. E. Atkinson, State highway engineer.)

MAINE

Under an act passed in 1913 "the governor with the advice and consent of the council shall appoint a State highway commission consisting of three members; one to serve three years, one to serve two years and one to serve one year.

"The commission shall select, and with the approval of the governor and council appoint a chief engineer, upon terms to be fixed from time to time by the commission, subject to the approval of the governor and council."

He shall under the direction of and control of the commission have general charge of the office, the records [and all construction and maintenance work, and may with the approval of the commission employ necessary clerical assistance. The engineer may with the approval of the commission employ such other engineers, supervisors, assistants and help as he may deem necessary.

The commission shall lay out, construct and maintain a system of State and State aid highways. The State highways to be constructed wholly by the State from the bond issue. The State aid highways to be constructed by the State and municipalities jointly. Both classes of highways to be maintained under the direction of the commission, the cost to be borne jointly by the State and municipalities. The charge against the municipalities for maintenance of State highways shall be $60 per mile per annum; for State aid highways, the charge shall be one-half the actual expense but not to exceed $30 per mile per annum.

The commission have full power in the letting of all contracts for the construction of all State and State aid highways. The commission may make contracts with towns for construction of State aid roads without advertising for bids.

Towns may make the following appropriations and apply for State aid:

Towns having a valuation of $200,000 or less may appropriate any amount, not exceeding $300; towns having a valuation of over $200,000 and not over $800,000 may appropriate any amount not exceeding $533; towns having a valuation of over $800,000 and not over $1,000,000 may appropriate an amount not exceeding $600; and towns having a valuation of over $1,000,000 and not over $3,000,000 may appropriate in addition to the sum of $600 an additional sum of $66 for each $200,000 or fraction thereof valuation in excess of $1,000,000; towns having a valuation of over $3,000,000 and not over $4,000,000 may appropriate, not exceeding $1333, and towns having a valuation of $4,000,000 may appropriate in addition to the sum of $1333 an additional sum not exceeding $133 for each additional $1,000,000 of additional valuation.

The commission from the funds for State aid construction shall to each town which has conformed to the provisions of the act, for each dollar so appropriated, apportion the following amounts:

To each town having a valuation of $200,000 or less, $2 for each dollar appropriated by said town; to each town having a valuation over $200,000 and not over $1,000,000 $1 for each $1 appropriated by said town; to each town having a valuation of over $1,000,000 and not over $1,200,000 92 cents for each $1 appropriated by said town; to each town having a valuation over $1,200,000 and not over $1,400,000,85 cents for each $1 appropriated by said town; to each town having a valuation over $1,400,000 and not over $1,600,000 80 cents for each $1 appropriated by said town; and to each town having a valuation over $1,600,000, 75 cents for each $1 so appropriated by said town. The money appropriated by towns applying for State aid with the amount apportioned by the commission shall constitute a joint fund for the construction and improvement of the State aid highways in such towns.

After the year 1913, between the 15th day of July and the 15th day of August in each year, municipal officers shall prepare and file with the commission, suggestions for the improvement during the next calendar year of State aid highways located in each town accompanied by plans so far as practicable, setting forth the location of the highway and the nature of the improvement desired. The commission shall examine and report thereon with its recommendations to the municipal officers on or before the 20th day of February following. Such reports shall be submitted to the voters of such towns at the next regular meeting.

To provide funds for the construction of State aid highways there shall be appropriated for the year 1913 the sum of $250,000 and annually thereafter there shall be appropriated the sum of $300,000. To provide for the administration of the office and duties of the commission and for all expenditures, salaries and expenses incident thereto, and for the maintenance of all State and State aid highways there shall be appropriated the sum of $50,000 annually. For the construction of the State roads the treasurer of State is authorized under the direction of the governor and council to issue from time to time serial coupon bonds, not exceeding $2,000,000 in amount outstanding at any one time, payable at the State treasury within forty-one years from date of issue; the interest on the bond isse and retirement of bonds to be provided for from the automobile license fees. Not more than $500,000 of bonds shall be issued in any one year.

The fund for maintenance and administration is augmented each year by the balance remaining on the 31st of December in the appropriation for State aid highways; that is, so much of the state's appropriation for this purpose as has not been apportioned to municipalities on account of State aid is automatically carried into the fund for administration and maintenance for the succeeding year. This fund is further augmented by the balance remaining in the fund created by the licensing of automobiles after providing for the payment of interest on the bonds issued and a sinking fund for the retirement of bonds. (Approved by Paul D. Sargent, chief engineer, State highway commission.)

MARYLAND

The State roads commission consisting of six members appointed by the governor has direct control over the construction and maintenance of a system of main highways through all the counties in the State, the cost of such construction and maintenance to be borne entirely by the State. The commission also has authority to approve applications for State aid on roads not included in the trunk-line system, and when such applications are approved the plans and specifications are prepared by the State, the contract awarded by the counties subject to approval of the State, and the performance of the contract supervised by the State.

The cost of State aid roads is shared equally by the State and counties. The allotment of State funds to the counties is based upon road mileage. After the construction of a State aid road its maintenance devolves upon the county authorities subject to the approval of the State. The revenues from the automobile-license law go to the maintenance of State and State aid roads according to their mileage after deducting 20 per cent for Baltimore City.

A system of trunk-line roads, built and maintained entirely at the expense of the State, was authorized by the legislature in 1908, and a State bond issue of $5,000,000 was authorized for this purpose. An additional bond issue of $1,000,000 was authorized by the legislature in 1910, and in 1912, a bond issue of $3,170,000 was authorized. The trunk-line system is selected entirely by the State roads commission and every stage of the work is completely under the control of the commission. A chief engineer selected by the commission is the executive officer and active head of the work. The funds for State aid roads as distinguished from State roads are provided by direct appropriation. The legislature in 1912 provided that an annual State tax of 1 cent on each $100 should be levied to provide a maintenance fund for State Highways. (Approved by Henry G. Shirley, chief engineer, State roads commission.)

MASSACHUSETTS

A State highway commission consisting of three members appointed by the governor for a term of three years, one term expiring each year, has control over the construction and maintenance of roads, partially or wholly paid for by the State.

The duties of the commission relate to roads and automobiles. Its duties so far as they relate to roads are: (*a*) The collection of statistics as to road materials and road conditions in the State, the making of maps, the giving of advice to local road authorities, etc.; (*b*) the laying out and construction of State highways, the improvement of certain town roads, and the supervision of maintenance of State highways.

The State highways are such as are designated by the commission upon petition of the city government, the board of selectmen, or the county commissioners. As soon as (a) highway has been thus designated, it passes under complete jurisdiction of the State highway commission, which has control not only of construction and maintenance but also of the location of water and gas mains, poles or other structures, the planting or cutting down of trees on the right of way, etc.

The cost of constructing State highways is borne as follows: 75 per cent by the State and 25 per cent by the county in which the highway is located, the State paying the entire cost in the first instance and collecting as a refund the 25 per cent from the county.

In order to aid the small towns, 15 per cent of the amount appropriated annually for State highway construction may be expended as follows: 5 per cent in towns of less than $1,000,000 valuation, upon petition, the town making no contribution; 5 per cent in towns of less than $1,000,000 valuation, the towns contributing an equal amount; and 5 per cent in towns of more than $1,000,000 valuation, the towns contributing an equal amount, which amount must be in excess of its average annual appropriation for roads for the last five years.

This has been amended by the acts of 1913, chapter 774, which provides that when any road has been constructed or improved, in whole or in part, with money furnished by the commonwealth, and is not laid out as a State highway, the city, town, or county shall at all times keep it in good repair and condition. The commission shall from time to time notify the authorities in charge of the road whenever it is not so kept in condition, and shall specify what repairs or improvements are necessary, and said authorities shall forthwith proceed to make the specified repairs and improvements. If not made within sixty days (unless further time is allowed) the commission may do the specified work and pay for the same from any money available for the maintenance of State highways or from the part of the motor vehicle fees' fund available for work on through routes in the towns (20 per cent of the net). The amount of such expenditure shall be collected back in the manner in which the expense of repairs on State highways is collected (see above). The money collected to be available for use for the same purposes for which the money so expended was available, or for the repair and maintenance of State highways: but in towns of under $1,000,000 valuation not more than $50 a mile a year; in towns with a valuation of over $1,000,000 and under $2,000,000 not more than $100 a mile a year, and in towns with over $2,000,000 valuation not more than $200 a mile a year shall be collected in any one year; but any balance due may be collected in succeeding years, the maximum collection in any one year being as above stated. The commission may upon petition exempt any town from the whole or any part of such payment if in its judgment said payment would prove to be an undue burden.

The State highway commission maintains the State highways at the expense of the State in the first instance, and the counties are required to repay to the State 25 per cent of the amount expended by the State for maintenance. This has been amended by the acts of 1913, chapter 773, so that not exceeding $50 a mile a year is collected back from towns of under $1,000,000 valuation; not exceeding $100 a mile a year from towns whose valuation is from $1,000,000 to $2,000,000; not exceeding $200 a mile a year from towns whose valuation is from $2,000,000 to $5,000,000 and in cities and towns of a valuation of over $5,000,000, one-half said expenditures, not exceeding $2000 a mile in the aggregate, and not exceeding $500 a mile in any one year, shall be made a part of the State tax and collected, and any balance due may be made a part of the State tax for the succeeding three years. The amount collected shall be credited to the appropriation for State highways, to be used again by the commission.

The State road revenues are derived from State bond issues, usually authorized for five years, one-fifth of the amount authorized to be issued each year during the five-year period. The present bond issue is at the rate of $1,000,000 per annum. Of the automobile fees and fines, after deducting the expense of administering the automobile department, 80 per cent is applied to the maintenance of State highways, and 20 per cent is spent on through routes in the towns. The net fees, fines, etc., now amount to from $500,000 to $600,000 per annum. In addition, the legislature makes direct appropriations from time to time to meet special expenses and additional maintenance cost.

As indicating the manner in which the law is carried out in relation to road construction by the State highway commission, it may be stated that contracts are awarded by the commission to the city or town in which the highway is to be laid out, if prices are satisfactory to the commission and if the contract is acceptable to the local authorities. The work is then done by the local authorities under the direction of the commission and its engineers. The contracts for State highway construction are usually based on given unit prices for each item of work, while the small town contracts are on the lump-sum basis. If the local authorities do not take the contract, bids are advertised for and awarded in the usual way.

The organization of the commission is as follows: A central office at Boston with three commissioners, a secretary, the various assistants in the highway department, the motor-vehicle department, and a chief engineer. The State is divided into four divisions each in charge of a division engineer, who has the necessary assistants and resident engineers, who are employed directly on the work. State issues bonds for road construction. (Approved by Col. Wm. D. Sohier, chairman, Massachusetts highway commission.)

MICHIGAN

The law provides that in 1913 and every four years thereafter a State highway commissioner shall be nominated and elected by the people at the same time and in the same manner as the justices of the supreme court. He is required to be a citizen of the State and may appoint a deputy, who shall be a civil engineer skilled in road building, and such other assistants as may be necessary. His duties are to give instruction in road and bridge construction and maintenance, to collect statistics, and distribute State-reward funds or any funds given to the State for such purposes by the United States government or by individuals. He is required to give expert advice to the local authorities and is required to make a map of every township in the State showing the roads and their condition and the location, kind, and quantity of road materials, etc. His decision is final as to whether a road merits State reward, and he may withhold any portion of the reward until the road has been thoroughly tested.

Whenever any township board or board of county commissioners have made arrangements to improve a mile or more of public road by constructing a sand-clay, gravel, stone-gravel, gravel-stone, macadam, or concrete road and ask for an allotment of State reward, and file with the State highway department a profile of the highway to be improved, and make application for plans and general specifications, the State highway commissioner shall furnish the plans and specifications and allot the funds from the State treasury as the State reward if, after completion, he finds the road to be up to the required standard. Each surveyed township is entitled to receive State reward on no less than 1 or more than 4 miles of road in any one fiscal year. The reward is allotted as follows:

a Each mile of well graded road, with grade not exceeding 6 per cent, except where found impracticable and a steeper grade is recommended after examination by the State highway commissioner, width not less than 20 feet between side ditches, properly drained, with travel track not less than 9 feet, made of a mixture of sand and clay, shall merit if approved by the State highway commissioner, a reward of $250 per mile, and pro rata for extra miles, with an extra $25 for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

b. Every mile of well graded road having not to exceed 6 per cent grade, except where found impracticable and a steeper grade is recommended after examination by the State highway commissioner, width not less than 20 feet between ditches, well drained, travel track not less than 9 feet, surface not less than 8 inches compacted gravel applied in not less than two courses, each rolled separately, shall merit, if approved by the State highway commissioner, a reward of $500 per mile, with an extra $50 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

c. Every mile of well graded road having not to exceed 6 per cent grade, with not less than 20 feet between ditches, well drained, travel track not less than 9 feet and having a foundation not less than 4 inches of crushed stone, slag or other material compacted, and top course of layer of gravel not less than 3 inches, shall merit, if approved by the State highway commissioner, a reward of $750 per mile, with an extra $75 for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

d. Every mile conforming to the above conditions as to grade, width, drainage, etc., and having a bottom course of gravel, slag or other material not less than 4 inches thick after rolling and a top course of crushed stone not less than 3 inches thick after rolling shall merit, if approved, a reward of $750 per mile, with an extra $75 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

e. Every mile conforming to the foregoing as to width, grade, drainage, etc., and having a surface of well compacted macadam not less than 6 inches thick laid in not less than two courses, each properly bonded, shall merit, if approved, a reward of $1000 per mile, with an extra $100 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

f. Every mile conforming to the foregoing as to width, grade, drainage, etc., and having properly laid concrete not less than 6 inches in thickness with or without a paving brick surface, shall merit, if approved, a reward of $1000 per mile, with an extra $100 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

g. Every mile conforming to the foregoing as to width, grade, drainage, etc., and consisting of a paving brick surface laid on gravel, sand, broken stone or slag, the quality of brick, manner of laying and kind of inspection employed to be made to comply with the specifications made by, or approved by the State highway commissioner, shall merit, if approved, a reward of $1000 per mile, with an extra $100 per mile for each additional foot in width of metaled surface in excess of 9 feet up to and including 16 feet.

Two or more townships may act jointly in the improvement of boundary line roads.

Upon application by the highway officials to the wardens of the various State penitentiaries, State prisoners may be put to work upon the highways or may be used in quarries for preparing road material.

The 1913 legislature of Michigan passed what is known as the trunk line highway act, which delineates certain highways leading from town to town in the State, totalling about 3000 or 4000 miles, upon which townships and counties will be entitled to double the State rewards mentioned above, when they build roads according to specifications drawn by the State highway department. The fixing of the location of these routes between towns, the preliminary surveys and the drafting of specifications are in the hands of the State highway department, while the construction of the roads is in the hands of the townships and counties through which they pass. (Approved by Leroy C. Smith, deputy State highway commissioner.)

MINNESOTA

The State highway commission consists of three members appointed by the governor and holding office for three years and serving without compensation, one new commissioner to be appointed each year. The commission holds meetings not less than once in each month and appoints a secretary who shall be a civil engineer and practical road builder and be known as the State engineer, and holds office subject to the pleasure of the commission. They may also employ other assistants and fix their compensation. The commission shall make report to the governor annually.

The State engineer is required to give advice under the rules of the commission and to perform such other engineering services for other State departments as the governor may require. He shall make all necessary surveys, establish grades, prepare plans and specifications, and have supervision of all work on State roads. He shall make an annual inspection of all bridges exceeding 30 feet in length, shall make report on their condition with recommendations to the State highway commission and county boards. The commission is authorized to investigate the location of road materials, investigate methods of construction, systems of road administration, hold public meetings, and apportion State aid.

A State road fund is created by an annual tax levy of 1 mill on each dollar of valuation, together with all money accruing from investments in the internal improvement land fund. The State highway commission allots this fund to the various counties, but no county shall receive in one year more than 3 per cent nor less than 1 per cent. Twenty per cent of the allotment shall be used only for maintenance of State roads and bridges. In determining the percentage accruing to each county the commission shall take into consideration the area, the amount of money expended in road construction, the difficulty and expense of such construction, and the extraordinary expense connected with the development of new territory.

Any county board may with the consent of the Highway Commission designate any established road in the county as a State road, and, if the cost does not exceed $500, cause surveys to be made when necessary by a State assistant engineer and then proceed with the construction. If the cost is over $500 the county board shall cause survey and plans and specifications to be made by the assistant State engineer and submit the same to the State highway commission for approval. When such approval has been obtained the county board proceeds to do the work under the supervision of the assistant State engineer, who acts under instructions of the State engineer. After completion, if the State highway commission approves the work, the State engineer certifies to the same and a warrant is issued by the State auditor for a share as provided by the law of the amount expended, but in no case shall the warrant exceed the amount allotted to such county. The assistant engineers throughout the State are appointed by the State highway commission and act under the instructions of the State engineer. The appropriation for State highway department is $150,000 per annum. (Approved by Geo. W. Cooley, state engineer.)

MISSISSIPPI

Mississippi has no State highway department, and the control of the roads, ferries and bridges of the State is vested in the county boards of supervisors by the constitution.

MISSOURI

The State highway commissioner is appointed by the governor for a term of four years. The highway commissioner also appoints a deputy engineer. The duties of the State highway commissioner are to devise plans and estimates for road and bridge construction and hold public meetings, to give assistance and advice to local road officials, to issue bulletins, etc. He has authority over road work and over the distribution of State aid apportioned to the counties, but his work is also investigative and educational.

The first State aid for roads in Missouri was the equal division of the war debt fund of $475,000 among all the counties in 1907. This was given without condition and without any supervision of its expenditure by State authorities. At the present time a State tax is levied upon certain market transactions and is known as the "stamp act." The income from this act was about $26,846 in 1913 and was distributed among the counties in proportion to the school attendance. The automobile licenses yielded $173,810.50 in 1913 and this fund is disbursed: $225,000 for the biennial period for dragging of roads, county seat to county seat, or actual mileage and at $15 per mile per year payable monthly on requisition on Auditor approved by the State highway commissioner. This fund, owing to mileage being much more than makers of bill estimated, will only cover a period of about one year, but by reason of the State highway commissioner holding back approval of requisitions and the lapse of time necessary to get roads approved, the fund will be nearly sufficient for the needs of the counties. Where roads cannot be dragged the law may be applied for betterment. There is also another law which when parties put up a certain sum with the county court the said court must, if they have funds, give a like amount, and then the State is drawn on for an amount equal to what both the individual and county has advanced but no county shall receive in any one year more than 3 per cent of the whole amount. The plans for work costing more than $1,000 per mile shall be approved by the State highway commissioner.

There goes into the general good roads fund all monies received from corporation fees, which amounted in 1913 to $77,873,59. (Approved by Col. Frank W. Buffum, state highway engineer.)

MONTANA

Under an act of the legislature passed in 1913, the governor is required to appoint a State highway commission of three members consisting of the professor of civil engineering of the Montana State College of Agriculture and Mechanic Arts, ex-officio; the State engineer, ex-officio; a civil engineer who is a trained and experienced road builder, who shall hold his office subject to the pleasure of the governor and act as secretary of the commission. He is required to devote his entire time to the work and is to receive a salary of not to exceed $3500 per annum. Each ex-officio member of the commission is to receive a per diem of $10 while the commission is in session, in addition to their actual and necessary expenses, provided that no ex-officio member shall receive for services and expenses a sum in excess of $1200 per annum. The commission is required to meet not less than once a month. The duty of the commission is to give advice, assistance and supervision in regard to road construction and maintenance, throughout the State. The attorney-general is made ex-officio attorney for the commission.

The board of county commissioners in each county is required within six months after the passage of the act to have prepared duplicate road maps of all public roads in the county as well as public roads constituting boundaries between counties and designate on the map such roads as the county board considers of sufficient importance to justify their improvement under this act. One of the maps is filed with the county clerk and the other is forwarded to the State highway commission with a statement of the location in the county of all deposits of road material. If the county board fails to carry out the provisions of the act, the state highway commission may proceed to obtain the information and deduct the amount thus expended from the first apportionment to such county.

The State highway commission is required on or before January 1, 1914 to prepare a map showing all public roads in each county, and all roads which the commission deems of sufficient importance to entitle them to State aid. The commission may in coöperation with the county commissioner divide the roads into two classes, one of primary importance and the other of secondary importance, the primary roads to be the first improved.

A State highway fund is created consisting of $5000 direct appropriation to pay the expenses of the commission until the amount credited to the State highway fund is available, thereafter the expenses of the highway commission to be paid out of the said highway fund. There does not seem to be any further provision in the act looking to the appropriation or creation of a State highway fund, although the motor vehicle law provides the motor fees shall be apportioned in the same manner as the State highway fund.

The act states that on or before the first Tuesday of March of each year the highway commission shall apportion the State highway fund among the different counties of the State and notify their respective boards of county commissioners. The highway commission is given discretion as to the amounts to be apportioned to the representative counties and is required to take into consideration the area of the county, the amount of money to be expended by it, the difficulty and expense of road construction and extraordinary expenses connected with the development of new territory. The commission is not allowed to spend any of the funds within the corporate limits of cities or towns or in any of the counties in which the county commissioners have not provided for the raising of an amount equal to the amount set aside by the State highway commission. If any county within ninety days fails to avail itself of the act, the highway commission may apportion its allotment among the other counties. The commission is authorized to adopt rules and regulations for the construction and maintenance of State roads. The board of county commissioners is required to make the necessary surveys, plans, specifications and estimates for State roads, in accordance with rules and regulations of the state highway commission, which is authorized to approve or disapprove of the same. The actual construction or maintenance of state roads is under the direction of the State highway commission. The boards of county commissioners may for such work employ a competent civil engineer at not to exceed $12 per day. Contracts are let by the boards of county commissioners.

The boards of county commissioners are required to make a report on or before December 30 of each year to the State highway commission showing in detail all money expended by such county during the current year in the construction and maintenance of the public roads. One part of the report shall cover State roads and the other portion cover all other roads.

The State highway commission is required to make a biennial report to the governor.

NEBRASKA

The county board of commissioners is required to have bidders on bridge work use forms provided by the secretary of State board of irrigation. The county board is forbidden to let a contract for a bridge costing over $500 except upon plans and specifications of the secretary of the State board of irrigation, who is required also to inspect and check that completed work.

The State board of irrigation is constituted by law. The State board of supervision for bridges and the State engineer is empowered to carry out the orders of the board.

The board of county commissioners may make application to the State board of irrigation for State aid in the construction of any bridge over a stream of 175 feet or more in width, pledging the county to furnish one-half the cost of construction, and, if the application is approved by the State board, the contract is let jointly by the said county board and the State board of irrigation. The plans and specifications are furnished by the State engineer and the construction is under the joint supervision of the State board of irrigation and the board of county commissioners. A State levy of one-fifth of 1 mill on the dollar constitutes the "State aid bridge fund."

The State board of irrigation, highways and drainage is empowered to advise with county boards on highways and bridges. The board is authorized to establish an advisory board of three members to supervise the expenditure of any funds that may be provided by the federal government for highway and bridge construction.

NEVADA

A law passed by the legislature of Nevada, and approved by the governor March 16, 1911, provides that the State engineer shall have general supervision of road work carried on by convict labor. An appropriation of $20,000 was made to cover the work, which was more in the nature of an experiment with convict labor than of expecting any large results from so small an appropriation. No appropriation was made by the last legislature to continue the road work with convict labor. A brief outline is all that I can give you, regarding the road work under State supervision for the period of 1911–1912. The above statistics, of course, may be used to head the report.

On June 1, 1911, work was commenced on a State highway between the cities of Carson and Reno; about 1½ miles of standard macadam road was constructed on the Carson end of the road; about 6 miles of road shaped and filled on the Reno end of the road. The type of construction used on the Reno end of the road was macadam, using a rock which was found about 5 miles from Reno and which proves to be an excellent road material. A total of about 20 miles of the road was repaired to permit of fast auto travel the entire distance. (Approved by W. W. Kearney, state engineer.)

NEW HAMPSHIRE

The governor and council have authority to appoint a State engineer and necessary assistants and fix their compensation.

The governor and council shall act upon all applications for State aid and apportion the aid among the counties, cities, and towns making application. The State engineer, under authority of the governor and council, prepares plans and specifications for all State aid road work. The governor and council, through the State engineer, are required to designate for improvement three continuous highways known, respectively, as the East Side Road, the Merrimac Valley Road, and the West Side Road. On these roads the towns receive at least dollar for dollar from the State and additional amounts as governor and council may decide.

Aside from the State highways the State grants aid to the towns on the following plan:

Each town, out of the money raised for highway purposes, shall set aside the following amount for the improvement of its highways under the supervision of the State engineer: Towns having a valuation of less than $2,000,000, $1 on each $1000 valuation; towns of $2,000,000 and less than $3,000,000 valuation, 75 cents on each $1000 valuation; towns of $3,000,000 and less than $5,000,000 valuation, 50 cents on each $1000 valuation; towns of $5,000,000 and less than $15,000,000 valuation, 33⅓ cents on each $1000 valuation; towns from $15,000,000 and upward valuation, 25 cents on each $1000 valuation; counties in which are located unincorporated towns, $1 on each $1000 valuation. If a town desires State aid for permanent improvement in addition to the improvement provided by the foregoing method, it shall raise an additional amount equal to 50 per cent of this sum and then make application for State aid. They shall then receive for each additional dollar so set apart the following amounts: Towns having a valuation of less than $100,000, $3 for each $1 so set apart; $100,000 and less than $150,000, $1.25 for each $1; $250,000 and less than $500,000, 60 cents for each $1; $500,000 and less than $1,000,000, 40 cents for each $1; $1,000,000 and less than $3,000,000, 25 cents for each $1; $3,000,000 and upward, 20 cents for each $1.

The amounts thus set aside by the towns, respectively, constitute a joint fund for permanent improvement. After plans and specifications have been approved by the State engineer the governor and council may permit the town to execute the work if it desires to do so; otherwise the work shall be let to the lowest bidder.

The State road funds for trunk lines are provided by State bonds bearing not to exceed 3½ per cent interest. A direct appropriation is made annually for paying interest and installments on the bonds. The regular State aid not on trunk lines is met by current appropriations. The law provides that 65 per cent of the fees and fines from motor vehicles shall be used for maintenance of trunk-line roads and 35 per cent for maintenance of State aid roads not on trunk lines. (Approved by S. Percy Hooker, state superintendent of highways.)

NEW JERSEY

The State highway commission consists of the governor, president of the senate, speaker of the house of assembly, the State treasurer, who serve without compensation, and the commissioner of public roads.

The commission is required to establish a continuous State highway system of improved main traveled roads connecting counties, cities, seaside resorts, large centers of population, outlets at the boundaries of the State, the Ocean Highway, and the Delaware River Drive, and the State commissioner of public roads is directed to submit to the commission a map showing the proposed system, the aggregate mileage of which shall not exceed 1500 miles.

The commissioner of public roads is appointed by the governor for three years. His staff is composed of civil-service employees who hold office, unless removed for cause; a State highway engineer who is chief engineer; and four division engineers ten regular inspectors and six foreman who are intended to form the nucleus for a trained corps of inspectors. In addition to this force the commissioner may appoint a local supervisor or inspector when necessary on each contract at compensation of $3 per diem.

The State commissioner of public roads is directed to take charge of the construction, improvement, and maintenance of the State highways comprising the State highway system, all such work to be done at the expense of the State, the plans and specifications to be prepared by the State highway department and supervision to be exercised by the department.

The commissioner of public roads is intrusted with the execution of the law granting State aid in the improvement of highways, such highways being in addition to the State highways. The commissioner, after conference with the board of chosen freeholders in respective counties and other local authorities, passes upon requests for aid in road improvement. The surveys, plans, estimates, and specifications are made locally, but must be approved by the State commissioner of public roads before the local authorities advertise for bids. Later the contracts and bonds are examined and approved by the commissioner before work begins. After the work has been completed to the satisfaction of the local authorities a written statement with detailed cost data is submitted to the commissioner, and if after inspection it is approved by him the State's portion of the cost, amounting to 40 per cent, is sent to the county.

After final approval by the State commissioner of public roads such roads shall thereafter be county or municipal roads, to be maintained by the county board of freeholders and the county supervisor or by the township or municipal officers. If the county fails to repair the road within 60 days after notice in writing by the State commissioner, he shall certify such neglect to the State comptroller, who shall withhold payment to the county of any money that may be apportioned to it until such repairs are made. The State road fund includes appropriations made by the legislature and the receipts from motor vehicle licenses and fines.

The commissioner of public roads may grant aid in the construction of bridges on roads being improved to the extent of 20 per cent of their cost, otherwise the State takes no part in the cost of building or maintaining bridges, the only exception being the bridge over the Raritan River to Perth Amboy, for the maintenance of which the State pays one-third, in accordance with the terms of a statute passed in 1912. (Approved by Col. E. A. Stevens, State highway commissioner.)

NEW MEXICO

The State highway commission consists of the governor, the commissioner of public lands and the State engineer, all of whom serve without compensation. The commission is required to meet four times a year, in January, March, June and September, and hold such special meetings as they consider necessary. The commission has general supervision of all highways and bridges constructed or maintained wholly or partly by the aid of State money. The commission is required to construct, prepare and maintain at the expense of the State either wholly or in part such public roads as best serve the interest of the general public, looking to the construction and maintenance of a complete system of highways. The commission is directed to investigate the needs of the various localities and to coöperate with the various boards of county commissioners in road construction.

In order to provide State aid fund an annual tax is levied not to exceed 1 mill on each dollar of taxable property, the sum thus realized to be turned over to the State treasurer and constitute the road fund which is subject to the orders of the highway commission.

The commission is required to make an annual report on or before January 1.

The State engineer is the engineer of the highway commission, and subject to its orders, has supervision of the construction and maintenance of all highways and bridges under the State aid act and also has supervision of all county bridges built by contract where the amount exceeds $1000. No bridge costing more than $1000 shall be constructed until the State engineer first approves the site, the contract and specifications.

The commission is authorized to do educational and investigative work.

In extending State aid preference is to be given by the commission to those counties which shall contribute an amount at least equal to that appropriated by the commission.

Certain specific State roads are provided for by State legislation.

The State highway commission is required to appoint in each county a county road board of three members to serve without compensation and to hold office for a period of three years subject to removal by the commission for cause. The county road boards are required to make an annual report to the State highway commission. The county road boards have full charge of road funds in their respective counties. The position of road supervisor was abolished in 1912.

NEW YORK

The State commission of highways consists of a single commissioner who is appointed by the governor with the consent of the senate for a period of five years.

The commissioner of highways appoints a secretary, auditor, and three deputy commissioners. Each of the deputy commissioners has had practical experience in the actual building, construction, and maintenance of highways and is familiar with the operations and effect of State statutes relating to highways and bridges.

The first deputy is a practical civil engineer, whose duties relate to the plans, specifications, and execution of all contracts awarded by the department.

The second deputy's duties relate to the maintenance of State and county highways, and the third deputy's duties relate to the improvement and maintenance of town highways and bridges. The commissioner has general supervision of highways and bridges constructed or maintained in whole or in part by the aid of State money; aids district, county, and town superintendents by advice and information; investigates methods of road construction and maintenance; compiles statistics, including highway map of the State; holds public meetings, etc. The State is divided by the commission into not more than nine divisions, each in charge of a division engineer who, under the direction of the commission, makes surveys, plans, specifications, and estimates for the construction and maintenance of highways in his division constructed wholly or in part by the aid of State money. All State and county highways on which the State expends money are inspected annually and a report prepared showing their condition, the improvements necessary, and the estimated cost, and a report made annually to the legislature setting forth the amount required for maintenance for the ensuing year.

If the board of supervisors of any county fail to appoint a a county superintendent of roads, the State highway commission is authorized to appoint such superintendent from the eligible list of the county and fix his salary, or place such county in a district with other counties and appoint a district superintendent. These district and county superintendents are subject to the regulations of the State highway commission. The town superintendent of highways, elected annually, is also subject to the regulations of the State commission of highways and is required to report annually to the district or county superintendent.

The highways of the State are divided into four classes, namely, State highways, improved and maintained at the sole expense of the State; county highways improved and maintained at the joint expense of the State, county and town; county roads improved and maintained by the county; and town highways improved and maintained by the town with the aid of the State.

The system of State highways is defined by law and the routes described. Such highways are to be improved from the funds from the sale of State bonds. The board of supervisors of any county may request that a certain designated highway be improved as a county or State highway. If the State commission of highways approves the request, it shall cause the division engineer to prepare plans and specifications, which are then sent to the division or county superintendent, who personally examines the highway and makes his recommendation to the commission. The commission may then finally adopt the plans and estimates and, if it be a State highway, advertise for bids and award contracts. If it be a county highway, the plans and estimates are transmitted to the board of supervisors for final approval.

The performance of every contract for State and county highways is under the supervision and control of the State commissioner of highways. When the board of supervisors of a county requests the improvement of a county highway it shall make appropriation of the county's share of the cost of such improvement. After final payment under contract the State commission files a statement of cost with the county treasurer, who thereupon pays upon the request of the commission the countys' share as follows: 2 per cent of the cost of each $1000 of assessed valuation of real and personal property in the county for each mile of public highway in such county, to exceed 35 per cent of the cost for the county. The maintenance of State and county highways is under the direct supervision of the commission, which also has authority to provide for a system of patrol of highways, the patrolman to be appointed by the State commissioner of highways. Each town pays for the maintenance of State and county highways annually $50 for each mile of said highway within the town.

The State annually contributes to the expense of maintenance of county roads which have been constructed without expense to the State 50 per cent of the amount appropriated by the county for the maintenance of such roads.

The State contributes to town highways on the following basis: (1) Where the assessed valuation of the town is less than $5000 for each mile of highway in such town, outside of incorporated villages, an amount equal to the amount of taxes raised for highways; (2) where the assessed valuation is $5000 or over and less than $7000 per mile an amount equal to 90 per cent of such taxes; (3) where the assessed valuation is $7000 or over and less than $9000 per mile an amount equal to 80 per cent of such taxes; (4) $9000 or over and less than $11,000, an amount equal to 70 per cent; (5) $11,000 or over and less than $13,000, an amount equal to 60 per cent; (6) $13,000 or over, an amount equal to 50 per cent. No town shall receive in one year an average of more than $25 per mile for the total mileage of roads outside of incorporated villages, and the amount which is raised by local taxation shall be such as will, when added to the amount received from the State, be not less than $30 for each mile of highway in the town.

A State bond issue of $50,000,000 was authorized in 1906 and an additional State bond issue of $50,000,000 in 1912. The bond issue was originally intended for the improvement of a system of county highways aggregating 8,380 miles, and to this was added a system of State highways aggregating 3,617 miles. The recent $50,000,000 bond issue is to be expended as follows: $20,000,000 for the construction and improvement of State highways and $30,000,000 for the construction and improvement of county highways. The apportionment among the counties is on the basis of population the measured mileage of public highways outside of cities and villages, and the total area, each factor having a weight of one-third. Direct appropriations are made by the legislature for maintenance. (Approved by R. K. Fuller, secretary, commission of highways.)

NORTH CAROLINA

This State does not make any direct appropriation for highway improvement but the State geological board is authorized to make investigations and give advice concerning highway improvement; and an annual appropriation of $5000 has been made for this purpose.

The legislature of 1913 authorized the working of State convicts on two special highways in the State: one in Henderson County, known as the Hickory Nut Gap Road; and one in Madison County as a link of the Central Highway. (Approved by Dr. Joseph Hyde Pratt, State geologist.)

NORTH DAKOTA

The State is prohibited by its constitution from granting aid in any manner in the construction or maintenance of highways. There has been, in effect, an act establishing an experimental good roads station at Bismarck, under the supervision of the board of trustees of public property, but no work whatever has been done under its provisions. The board of trustees is required to have the State engineer provide plans and specifications for the construction of the roads, and to furnish supervision. It is the intent of the act that inmates of the State penitentiary shall be employed in the construction of these roads. The principal reason that nothing has been accomplished is that all of the prisoners are needed to keep the regular industries of the penitentiary in operation.

The members of the State highway commission, consisting of the governor, the State engineer, and one other member to be appointed by the governor, serve without extra compensation. It is their duty to prepare plans and specifications and superintend the construction of any roads, when requested by any board having jurisdiction over such roads, and to give advice, assistance and supervision with regard to road construction throughout the state, as time and conditions permit, and as the rules and regulations of the commission may prescribe; to have prepared maps of the various counties showing the roads and location of bridges and culverts, and showing roads on which it is proposed to utilize state funds whenever such funds may be available. They shall also issue bulletins containing advice and suggestions, and the law concerning highway construction, from time to time, as they shall deem practicable.

It is the duty of the State engineer, when requested by any board of county commissioners or township supervisors, to prepare plans for the construction of any bridges or culverts, or to examine and report on existing bridges or culverts, charging to the county or township for which such work is done, the actual and necessary expenses and the cost of the work. (Approved by Jay W. Bliss State engineer.)

OHIO

The State highway commissioner is appointed by the governor, and holds office for four years. He is required to be a competent civil engineer and experienced in construction and maintenance of roads and bridges. He is required to appoint, subject to the approval of the governor, three deputy highway commissioners, no more than one of whom shall be of the same political party as himself, who shall be competent civil engineers and serve during the pleasure of the commissioner. The highway department is required to be divided into three bureaus, i.e., the bureau of construction, the bureau of maintenance and repair, and the bureau of bridges, each to be in charge of a deputy. The State highway commissioner may appoint the following division engineers: Four in the bureau of construction, two in the bureau of maintenance and repair, and two in the bureau of bridges. He may also appoint as many additional division engineers as may become necessary to carry out the provisions of the law.

The State highway commissioner has general supervision over the construction and maintenance of highways and bridges which are constructed or maintained by the aid of State money. He is required to advise with county commissioners and prepare plans, specifications and estimates for local roads when requested to do so by the county commissioners. He shall make inquiries into the methods of road and bridge construction throughout the United States, prepare bulletins, etc. He is authorized to call meetings in each county of the State and give instruction in road and bridge building, maintenance, and repair, and the county commissioners, county engineers, and township road district officers are required to attend, and are paid their regular per diem allowance for the actual time they spend in attending the meetings. He is also authorized to run a car for demonstrating methods of construction and maintenance. The equipment of the Ohio State University may be used by the State highway commissioner in investigating the chemical and physical character of road and bridge material, if the president of the university consents. The State highway commissioner is authorized to maintain inter-county highways, main market roads, bridges, and culverts constructed by the aid of State money or taken over by the State, and the State may pay the entire cost thereof.

In the granting of State aid for road improvement on inter-county highways, applications are made by county officials to the State highway commissioner and approved or disapproved by him. If he approves the application, he shall cause a map to be made and plans and specifications prepared, including bridges and culverts. He shall then prepare estimates and transmit a copy to the county commissioners. If they approve the construction of the road, they shall so notify the State highway commissioner, and he shall advertise for bids, and subject to the approval of the county commissioners, award the contract to the lowest bidder. Upon the completion of the work the State highway commissioner shall ascertain the cost and apportion the same on the following basis: 50 per cent by the State, 25 per cent by the county, 15 per cent by the township, and 10 per cent by the abutting property owners. The State's share is payable from the unexpended balances remaining to the credit of a county from the money appropriated by the general assembly, or from the State highway improvement fund, provided by an annual levy of one-half mill on all the taxable property of the State, first available in 1914. Seventy-five per cent of all money raised by said levy shall be applied to the maintenance of the State highway department and for the construction, improvement, maintenance and repair of an inter-county system of highways in the State. Twenty-five per cent of all moneys raised by said levy shall be used for the construction, improvement, maintenance and repair of certain main market roads in the State, and the same shall be located along and upon the route or portions of said inter-county highways.

The construction, improvement, maintenance and repair of the main market roads may be begun at any point and shall be executed in such manner and method, with such road materials and in accordance with such plans, details and specifications, as may be adopted by the State highway commissioner with the approval of the governor; and as to such main market roads there shall be no necessity for petitions being presented and filed as in other improvements and no procedure for constructions, improvement, maintenance and repairs of roads as is provided for in any other act or acts of the general assembly shall apply to such main market roads.

The highway commissioner shall have power to purchase such equipment and materials and employ such labor as may be deemed necessary to execute with skill and economy any work upon said main market roads without letting contracts for the same at public bidding; and he is further authorized to use convict labor in the building of said main market roads.

For the purpose of providing a fund for the payment of the proportion of the cost and expense to be paid by the county for the construction, improvement, maintenance or repair of state highways, the county commissioners are authorized to levy a tax not exceeding 1 mill upon all taxable property of the county. Said levy shall be in addition to all other levies authorized by law, for county purposes, subject however to the maximum limitation upon the total aggregate amount of all levies in force.

For the purpose of providing a fund for the payment of the proportion of the cost and expense to be paid by the township or townships for construction, improvement, maintenance or repair of State highways, the county commissioners or township trustees are authorized to levy a tax not exceeding 3 mills upon all taxable property of the township or townships in which such road improvement is situated, in whole or in part. Such levies shall be in addition to all other levies authorized by law for township purposes, subject however to the maximum limitation upon the total aggregate amount of all levies in force.

The commissioners of a county may, by a properly certified resolution setting forth that the public interests demand the improvement of a certain highway, described therein, make application to the State highway commissioner for aid from a State appropriation, or from any fund available, for the construction and repair of inter-county highways. Such application must be made prior to January 1, preceding the date when such appropriation becomes available, and shall not include any portion of a highway within the limits of a municipality. If the county commissioners have applied prior to January 1 and upon examination of the application by the State highway commissioner, it is found to be irregular, it shall be his duty to immediately notify the board of county commissioners and request that they make the proper correction or amend the petition and return the same to the office of the State highway commissioner on or before the first of February next succeeding. If the county commissioners have not made use of the apportionment to such county on or before the first day of May next succeeding, then the State highway commissioner shall enter upon and construct, improve maintain or repair any of the inter-county highways or parts thereof of said county, either by contract, force account, or in such manner as the State highway commissioner may deem for the best interests of the public, paying the full cost and expense thereof from the said apportionment of the appropriation to said county so unused as aforesaid. Any part of the apportionment to a county remaining unexpended shall remain to the credit of such county and be available for the succeeding year as herein provided.

Upon the receipt of an approval of an application from the State highway commissioner, together with proper plans, maps, and specifications, the county commissioners or township trustees may, by a majority vote, adopt a resolution authorizing said highway to be constructed, transmitting a copy of such resolution to the State highway commissioner. If the lines of a proposed highway deviate from those of an existing highway, the officials making application must provide the requisite right of way, and secure proper releases of damages, prior to the commencement of the work.

The county commissioners may, upon the petition of the owners of 25 per cent or more of the lineal feet of adjacent property, order the improvement of a public road, or section thereof, at least one mile in length, or less than 1 mile if it is an extension or connected with a permanently improved street or highway of improved construction. And they may require that the township or townships through which such road extends shall pay 25 per cent of the cost, excepting bridges and culverts; and that the trustees thereof shall approve the same. The county commissioners by resolution may relieve the township or property owners from any assessment. If more roads are petitioned for than can be constructed in any one year, the State highway commissioner and the county commissioners shall decide upon the road to be first improved, having in mind the importance of such road to the county or township.

No contract for road improvement unless otherwise provided shall be let until the county commissioners shall enter into agreement to assume their share of the cost.

The county commissioners of any county may waive any or all of the apportionment of the expense of highway improvement to be paid by townships or abutting property owners, and assume any part or all of the cost of such road improvement; and the township trustees may, in like manner, waive any or all the apportionment of the expense to be paid by the county or abutting property owners, and assume any part or all of the cost of such road improvement in excess of the amount received from the State. (Approved by James R. Marker, State highway commissioner.)

OKLAHOMA

Under a constitutional amendment the legislature established in 1911 a State department of highways consisting of a State highway commissioner to be appointed by the governor and to hold office for four years. The commissioner is required to have a recognized knowledge of construction and maintenance of improved roads and receives a salary of $2500 and actual travelling expenses.

The commission is authorized to employ an assistant engineer, such clerical force as may be necessary, at an annual expense not to exceed $5000. He is required to make a general highway plan of the State, collect information, prepare standard specifications and plans, and give advice to local officials. The local officials are required to furnish the State highway commissioner with information which he may request. The State highway department is maintained through a fund derived from state automobile license fees, as set forth in the chapter on automobile legislation. State convicts may be used in road work as explained in the chapter on convict labor legislation. (Approved by Sidney Suggs, State highway commissioner.)

OREGON

The 1913 legislature passed a law creating a State highway commission which consists of the governor, secretary of state, and state treasurer. The position of State highway engineer was created, at a salary of three thousand dollars per year, to be appointed by the State highway commission.

The duties of the commission are to determine a system of state roads and to construct the same as money becomes available for that purpose. The highway engineer is required to act in an advisory capactiy to the county courts of the different counties in the matter of road construction and maintenance, whenever so requested. On request of the county court of any county, the State engineer must furnish plans and specifications for any piece of proposed road construction, or any bridge, free of all cost to such county. (Approved by H. L. Bowlby, State highway engineer.)

PENNSYLVANIA

The act approved May 31, 1911, known as the Sproul good roads law provided for the appointment of a State highway commissioner, two deputy State highway commissioners (one of whom must be a competent civil engineer), an auditor, and a chief engineer. These appointments are made by the governor of the Commonwealth by and with the consent of the senate. The State highway commissioner shall appoint an engineer of bridges; 50 superintendents of highways; and 15 competent civil engineers, together with a chief clerk, chief draftsman, assistant draftsmen, and a force of clerks and stenographers.

The State highway commissioner shall cause to be made a survey of all roads of the State and a general highway plan of the State. He shall collect statistics, publish maps giving a complete road survey of each county, and may be consulted by county, city, borough, and township officials. He is directed to construct, improve, and thereafter maintain at the expense of the Commonwealth the highways forming the system of State highways, the specifications for which are to be prepared by the State highway department.

The State highway system, which comprises approximately 8,805 miles, shall be under the exclusive jurisdiction of the State highway department, and shall comprise the main traveled routes between county seats and principal cities, boroughs, and towns, and the main traveled routes leading to the State line.

Where the expense of constructing a route may be materially lessened by a change of location from that at present defined, the State highway commissioner may, with the approval of the governor, change the location of such a route.

Where a toll-road company controls any part of a route forming a State highway, the State highway commissioner may purchase said toll road at a fair and reasonable price, to be approved by the governor.

An appropriation of $2,800,000 was made at the 1913 session of the legislature for the construction, repair and maintenance of the State highways, improved and unimproved, for the two years ending June 1, 1915. Also, at the 1913 session of the legislature, there was a bill passed creating additional State highways, to become effective June 1, 1915, and another bill making changes in the now existing State highways, which became effective the date of approval, July 22, 1913. In addition to the State highway system State aid is granted for the improvement of other roads. Counties, townships, or boroughs (as the case may be) which desire State aid can proceed in the following manner: The township supervisors or commissioners or borough council of the township or borough in which the road lies shall first make petition to the county commissioners, and it shall then be the duty of the county commissioners to adopt a resolution assuming on behalf of the county its share of the cost of the proposed improvement. The county commissioners shall then petition the State highway department for State aid, the cost of the improvement to be pro rated among the townships or boroughs (as the case may be), the county, and the State, the State paying 50 per cent of the cost of reconstruction, the county and township, or borough (as the case may be), the other 50 per cent. If either the county, township, or borough desire to act independently of the other, they may make application direct to the State highway department and agree to assume 50 per cent of the total cost, in which event the other 50 per cent is paid by the State. The State also pays 50 per cent of the cost of maintenance, the other 50 per cent being paid by the township or borough in which the road may lie.

The State aid fund is apportioned among the several counties of the State according to the mileage of township and county roads. An appropriation was made at the legislative session of 1913 for the two years ending June 1, 1915, of $1,400,000, covering the permanent improvement and maintenance of State aid roads. (Approved by L. F. Neefe, chief clerk, State highway department.)

RHODE ISLAND

The State board of public roads, consisting of five persons, one from each county, is appointed by the governor for a term of five years. The board has direct control of the expenditure of all appropriations by the legislature for road improvement, and has supervision over the construction and maintenance of all State roads.

The entire cost of construction and maintenance of State roads is paid by the State. At the close of 1912 there were 294 miles of State roads under the direct control of the State board. A State bond issue of $600,000 was authorized in 1906 to bear 3 per cent and an additional bond issue of $600,000 in 1909, 1912, $600,000 the proceeds to be used in completing the system of State roads. No more than one-third nor less than one-seventh of the available appropriation in any year shall be expended in any one county. The proceeds of automobile licenses and fines are used for the repair of State roads under the direction of the State board of public roads.

In addition to the State highways, State aid is granted as follows:

Whenever any town shall make an annual appropriation equal to or in addition to the sum of 20 cents on each $100 of taxable valuation, and whenever the electors shall vote that said appropriation be expended under the direction of the State board of public roads a sum of money equal to one-fifth of the money so appropriated by any town is annually appropriated by the State for the care and maintenance of the public highways and bridges of said towns.

In 1912 legislation was enacted providing that bridges on State roads shall be under the control of the State board of public roads. (Approved by Peter J. Lannon, clerk, State board of public roads.)

SOUTH CAROLINA

The State does not grant aid and has no highway department but considerable amount of efficient investigative and educational work is done in behalf of road improvement by the State commissioner of agriculture, Hon. E. J. Watson.

SOUTH DAKOTA

A State highway department was established in July, 1913, consisting of a commission of three members. There is no provision in the road laws of the State for state aid or control of the highways. The work of the commission is to give advice and conduct educational work.

TENNESSEE

The State has no highway department and grants no aid to road improvement.

TEXAS

The State has no highway department and grants no aid to road improvement.

UTAH

The State road commission consists of the governor, the State engineer, the State treasurer, one member of the faculty of the Agricultural College of Utah and one member of the faculty of the University of Utah all of whom serve without compensation. The commission selects the roads which comprise the system of State roads; has charge of the expenditure of the State road building fund; furnishes plans, specifications and estimates on application of the county commissioner; prepares and issues a manuel of road building for public officials; gives information to local officials; submits report biennially to the governor. The county commissioners are required upon request of the State highway commission to prepare a map of the county showing location of county roads and shall designate the roads to comprise the system of State roads.

An appropriation is made from the general revenues of the State for the construction of State roads such appropriation to be expended equally in each county. The commission may require counties having an assessed valuation under $2,000,000 to duplicate one-fourth of the amount of the State road fund expended in said county, and counties having an assessed valuation of more than $2,000,000 and less than $4,000,000, duplicate one-half of the amount, and counties having an assessed valuation of more than $4,000,000 duplicate the full amount. Should the county default in the payment of its proportion, the State road commission is authorized to collect the amount of default from any moneys due said county in the hands of the State treasurer. Whenever the State road commission decides to improve a portion of the road in any county the county commissioners are required to levy a special road tax not to exceed 5 mills on all taxable property within the precinct, the amount thus realized to be used in connection with the county appropriation and the State road building fund but not in lieu of the amount to be appropriated by the county.

The State highway commission makes all plans, specifications, and estimates for the improvement of State roads, and awards contracts. The State roads in each county are to be kept in repair by the county.

State bonds are authorized under an act passed in 1911 in the sum of $260,000 to be expended by the State highway commission. The provisions of this act are explained in the chapter on bond issue legislation. The proceeds from motor vehicle fees are also applied to the State road fund. State convicts may be worked upon the State roads.

VERMONT

The State highway commissioner is appointed by the governor for a term of two years, and has control over the expenditure of all moneys appropriated by the State for highway purposes. He shall annually issue the same to the town road commissioners with plans, specifications, and advice. He appoints not to exceed one supervisor for each county to assist him in the performance of his duties. The State highway commissioner meets the road and street commissioners of the several towns and villages at least once annually, and these commissioners receive their per diem and necessary expenses for attending the meetings.

The selectmen and town commissioners select the roads on which State aid shall be expended, but such selection is subject to the approval of the State highway commissioner. The selectmen and the State highway commissioner may agree upon any plan of expenditure deemed best in any such town.

A State highway tax of 5 cents on each $100 is annually assessed and the amount thus derived is apportioned to the towns upon the basis of the road mileage therein, which shall be certified to the State treasurer by the selectmen. A direct appropriation is made to be available to cities and towns, excepting incorporated villages, as follows: When a town shall vote to raise money in addition to the amount required by law, an amount shall be apportioned to the town equal to the excess amount, provided it is not less than $100 or more than $1000 in any one year.

Automobile fees are used for the repair of main highways under the direction of the State highway commissioner.

VIRGINIA

A State highway commissioner is appointed by the governor, with the consent of the general assembly, for a term of six years. The commissioner, together with the professors of civil engineering of the University of Virginia, the Virginia Military Institute, and the Virginia Polytechnic Institute, constitute the State highway commission. The State highway commissioner is required to be a citizen of the State and a civil engineer versed in road building.

The State highway commissioner has supervision of the construction and maintenance of main-traveled roads of the State, may recommend to the governor and local authorities needed improvements, collect information and disseminate the same, and give advice.

Whenever the local authorities of any county desire to permanently improve any main road, they may make application to the State highway commissioner. If he approve such application he shall prepare plans, specifications, and estimates and submit a copy of same to the local authorities. If they decide to improve said road, they may make application to the State commissioner for State aid, which may be money aid or convict labor. If money aid is desired, the local authorities shall agree that the county will bear one-half of the cost of improvement and the State highway commissioner shall advertise for bids and the local authorities award the contract subject to the approval of the State highway commissioner. The work shall be done under his supervision. The money aid is apportioned among the counties of the State according to the total amount of State taxes paid by the respective counties. If a county pays more than 50 per cent of the expense it shall be entitled to receive annual apportionment until the receipts from the State shall equal 50 per cent of the cost of such permanent improvement.

If convict labor is desired, the local authorities shall undertake to supply necessary materials, tools, and teams, and have the work done under the supervision of a civil engineer, to be supplied by the State highway commissioner, at a salary not to exceed $1200 a year, to be paid by the county. The State commissioner then makes requisition on the superintendent of the penitentiary for such convicts as he may deem necessary. If the local authorities desire to do the work by contract, the labor of the convicts may be estimated at $1 per 10 hour day, and the State grant in this way not more than 40 per cent of the contract price. Counties may not receive both convict labor and money aid in the same year. Any county may use its apportionment of State money in the construction of bridges, and any county may determine what part of its 50 per cent of the cost of road or bridge construction shall be borne by the sub-divisions of the county.

Whenever any county or district shall issue bonds for road improvement, application shall be made to the State highway commissioner for a competent highway engineer to make plans and specifications and supervise the work, which shall be awarded to contract jointly by the State highway commissioner and the local authorities. The proceeds of automobile fees are expended under the direction of the State highway commissioner. (Approved by G. P. Coleman, commissioner, State highway commission.)

WASHINGTON

The State highway board consists of the governor, the auditor, the State treasurer, the State highway commissioner, and a member of the State railroad commission, to to be named by the governor. The State highway commissioner, who is appointed by the Governor for a term of four years, is required to compile statistics relating to public highways throughout the State, give advice to local officials, make recommendations as to needed State highways, with estimated cost. The State highway board shall apportion the amount appropriated for any State road to be expended withing the boundaries of the several counties through which the road may pass.

The permanent highway law provides for a tax of 1 mill on all property in the State, the amounts received from each county to be credited to the county paying the same until it shall be expended on contract for permanent highways in such county, 15 per cent of the cost of such permanent highway to be assessed on abutting property and the balance to be paid from the permanent highway fund. When a road is completed under this act, the highway commissioner is required to inspect it and certify to the State auditor that the work has been done in accordance with plans and specifications which were provided by him before the contractor can be paid the final 20 per cent on the contract. The legislature makes specific appropriations for specifically designated roads from time to time.

The State highway board is authorized to establish State quarries to be operated by convict labor. The material prepared at the State quarries shall be delivered to the State highway commissioner for use on State roads, or to any county, city, or town after the requirements of State roads work are met, at a price not less than 10 per cent above the estimated cost of production at place of delivery. Any surplus material may be sold. The State highway commission is authorized to appoint a superintendent of quarries. The State convicts may be used under the authority of the State board of control, in the building of State roads.

WEST VIRGINIA

At the 1913 session of the legislature a law was enacted establishing a State road bureau consisting of the professor in charge of the railway and highway department of the State university to be chief road engineer and chairman of the bureau; the director of the State experiment station and two additional members to be appointed by the governor. Both of these two members shall not be appointed from the same political party. The professor in charge of the railway and highway department at the State university is to be appointed by the governor. The bureau is to give instruction and advice in road building, collect data, test materials, and have such supervision of the roads of the State as is consistent with the constitutional provision on this subject and to see that all road laws are enforced.

The State grants aid to the counties in the form of convict labor to be employed under the supervision and in accordance with plans and specifications of the State road bureau.

The bureau is under the control of the governor.

The law requires all county prisoners to work on the roads, all justices to sentence the misdemeanor convicts to work on the road their sentence and also the fines and costs if not otherwise paid.

Prisoners not able to give bail or refused bail while awaiting trial may elect to work on the roads and if convicted get credit for the work done and if acquitted of the charge the county shall pay them 50 cents per day for the days worked.

The road bureau is stationed at the University and a highway laboratory has been established preparatory to testing road materials.

A special course in highway engineering has been provided. The law requires all county road engineers to attend this course for at least 10 days in each year. (Approved by A. D. Williams, chief road engineer.)

WISCONSIN

The State highway commission consists of five members, who are nonpaid except as to actual expenses. The dean of the college of engineering of the State University and the State geologist are members ex officio. The three other members are appointed by the governor. The commission in turn selects a State highway engineer.

The boards of county commissioners are required to select a continuous system of roads, to be known as "the county system of prospective State highways." These roads may be constructed by the town, county, and State jointly, each paying one-third of the cost, or a county can assume two-thirds of the cost and the State one-third. Bridges over 6 feet in span are paid for, two-fifths each by the town and county and one-fifth by the State. Improvements on this road system are made by a county highway commissioner selected by the county board under the general direction and in accordance with the plans and specifications of the State highway commission. After improvement, the hard-surfaced roads are maintained by the counties and the dirt roads by the towns. (Approved by William Dawson, chief clerk, highway commission.)

WYOMING

Certain highways have been designated as a system of public highways to be improved by State convicts, under the control of the State commission of prison labor. All locations and surveys of such highways are to be made under the direction of the State engineer, while the county commissioners are required to secure rights of way and construct bridges in connection with plans made by the State engineer.—An appropriation of $10,000 was made by the eleventh legislature to purchase the necessary equipment and meet expenses incident to utilizing convicts on this work.

An additional appropriation of $7500 was made by the last (twelfth) legislature for the purchase of additional tools and equipment. (Approved by A. J. Parshall State engineer.)

LOCAL ROAD LEGISLATION

County Systems

In each of the States of Alabama, Colorado, Florida, Georgia, Idaho, Indiana, Kansas, Maryland, Montana, Nevada, North Dakota, Ohio, South Carolina, Utah, Washington, West Virginia and Wyoming, the local road work is under the control of a board of county commissioners, elected by the people. The duties and authority of the boards of county commissioners are similar in most of the States. In Alabama the board consists of a probate judge and four other commissioners although, by special statute, boards of revenue or other like boards may be created to take the place of the board of commissioners.

In Alabama the board may appoint a supervisor of public roads for the entire county and similar authority is also possessed by the board of county commissioners of Colorado; in Kansas the county commissioners have authority over State and county roads and may appoint a county engineer or designate the county surveyor as county engineer, to have general supervision of all county road and bridge work under the authority of the board; in Maryland the county board has authority to employ competent civil engineers for the construction and maintenance of roads and bridges; in North Dakota the county board may appoint a county superintendent of highways; in Ohio the county surveyor is the executive in control of road work under the county board; in South Carolina a county supervisor has charge of the roads under the direction of the board of county commissioners; in Utah the board of county commissioners is required to appoint a county road commissioner biennially; in Washington the county commissioners appoint a supervisor for each district, but a county engineer is elected by the people every two years; in West Virginia it is optional with the board as to whether they appoint a county engineer; in Wyoming the voters of the county may elect a county supervisor of roads for a term of two years. In the other States mentioned in the foregoing list the county commissioners follow the old plan of dividing the county into suitable precincts or districts and appointing one or more overseers, this practice being varied in a few of the states by having the overseer elective instead of appointive.

Another group of States comprising Arizona, California, Iowa,[1]

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[1] See paragraph on centralized systems.

Mississippi, Virginia, have county boards of supervisors who have control of public roads, these boards differing from the boards of county commissioners only in name. In Arizona there is also a county superintendent of roads elected by the people who has the immediate supervision of county road work. A law which becomes effective January 1, 1915, in Arizona provides that the board of supervisors may appoint a county engineer at not to exceed $3000 per year salary, the county surveyor is the official having charge of the roads under the direction of the county board. In Iowa there is a distinction between county road work and township road work, the former being under the county board, and, the latter under boards of township trustees. In Mississippi one supervisor is elected from each district and has control of the roads in his district and may appoint a road overseer therefor. The five supervisors comprise the county board. In Virginia the board of supervisors of each county is required by law to appoint a county superintendent of roads or in their discretion appoint a superintendent of roads for each magisterial district or group of districts, or they may appoint both district superintendent and the county superintendent. In New Jersey the governing board of the county is designated the board of freeholders, which board has charge of all county roads and are required to appoint a county supervisor of roads who is required to report to the board, they also have a county engineer appointed by the board.

In Arkansas, Kentucky, Oregon, Tennessee, and Texas, the control of the public roads is in the hands of a single official who in Arkansas is known as the county and probate judge and appoints such road officials as he considers advisable; in Kentucky a county judge, who appoints with the consent of the fiscal court the county road engineer; in Oregon a county judge; in Tennessee a county judge, who presides over a court of county commissioners, consisting of four members besides the judge, the court divides the county into road districts and appoints a road commissioner for each district who in turn appoints road overseers for each section of road (toll roads are looked after by a board of turnpike commissioners selected by county court); in Texas a number of the counties have a county judge who appoints a county engineer or superintendent, while many other counties have boards of county commissioners who appoint county superintendents or engineers.

Louisiana is divided into parishes which are equivalent to counties. In each parish the governing body is known as a police jury, corresponding to county boards of commissioners.

In Delaware, which has only three counties, the governing body is a levy court, which appoints a county engineer. The levy court corresponds in many respects to the board of county commissioners or county courts of other States.

County and Township Systems

A third group of States comprising Illinois,[1] Michigan, Missouri, Nebraska, North Carolina, Oklahoma, Pennsylvania, South Dakota, and Wisconsin, have both county and township systems, some of the counties operating under one and some operating under the other. In Illinois the county board of commissioners of each county is required to submit to the State highway commission a list of from three to five persons from which list the State highway commission by competitive examination selects a person for county superintendent of highways, who is thereupon appointed by the county board. The term of office of the county superintendent of highways is six years and he is subject to the regulation of the State highway commission but may be removed by the county board for incompetence or neglect of duty. He has charge of the road and bridge work of the county where county funds are expended. In counties not under township organization the county board divides the county into road districts. In each township in the counties under township organization and in each road district in counties not under township organization there is a board of highway commissioners of three members each serving three years, one term expiring each year. These township or district boards have general control of the roads within their township or district. In Michigan a highway commissioner in each township under the control of a board has charge of construction and maintenance of earth roads while the county road commissioners have charge of the construction and maintenance of all roads taken over from the townships under the control of the board of three county commissioners. Missouri also has both a county system and a township system. In all the counties the principal governing body is the county court composed of three members. This court annually appoints a county highway engineer and fixes his salary. In ninety-two of the counties the county court has full charge and control of road affairs and divides the county into road districts and appoints overseers in addition to appointing the county highway engineer. In twenty counties the roads are controlled by the respective townships in each of which the governing body is a board of three township commissioners. Nebraska also has both the county and township system. In the former the county commissioners appoint a county highway commissioner in January of each year. In the counties under township organization the county commissioners divide the county into seven supervisor districts in each of which a supervisor is elected by the people. In counties under this form of government the township boards have control of the roads in their respective townships and they further subdivide the township into subdistricts and appoint road overseers. In North Carolina some of the counties have the county system and some the township system while a very large number of the counties operate under special laws. In Oklahoma most of the counties are operating under the township system in which a township board of trustees has charge of the roads, and appoint a road supervisor for each road district in the township. In counties operating under the county system the board of county commissioners elected by the people may appoint a county engineer. In Pennsylvania general jurisdiction over the roads vests in township boards of supervisors but under a recent county road act the board of county commissioners have control of such roads as are designated county roads. In South Dakota some of the counties are under county system and some counties under the township system. In Wisconsin the general charge of the roads is in the hands of the town boards consisting of three members elected annually although county boards are authorized to vote on the method of paying road taxes.

Town Systems

The States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut have the town system of government as contrasted with the county system so general in the southern States. The governing body in each of the towns is known as the board of selectmen, usually consisting of three members elected annually at the town meeting. The selectmen usually employ a road agent or highway commissioner but in many instances this latter official is elected by the people instead of appointed by the board of selectmen. Boards of county commissioners have some measure of authority in relation to roads, such for example in Maine where the county boards act in road matters for unincorporated towns. In most of the States named the county boards have some control over laying out new roads, altering or discontinuing roads from town to town. In Connecticut the county board may interfere when petitioned to do so or if the towns neglect to repair the roads.

Centralized Systems

In New York a rather centralized system prevails in that the State highway commission by reason of its granting aid to counties and towns exercises a limited supervision over practically the entire road mileage of the State. The governing body in the counties is a board of supervisors, and the governing body in the townships is a township board. A county superintendent of roads is appointed by the county board of supervisors or if they fail to appoint such a superintendent, the State highway commission makes the appointment or includes the county in a district and appoints a district superintendent. The term of office of the superintendent is four years but he may be removed by the State highway commission upon written charges, such superintendent is subject to the rules and regulations of the State highway commission. In the towns a town superintendent of highways is elected annually and has supervision of the highways subject to the regulations of the State highway commission. As the aid of the State is granted for construction, maintenance or improvement to practically every class of highway in the State, and as the various road officials conduct their work in accordance with the regulations of the State highway commission it is evident that the New York system is highly centralized.

In New Mexico under an act passed in 1912 a county road board is created in each county, to serve without compensation and to consist of three members to be appointed by the State highway commission for a period of three years and to be subject to removal by the commission for cause. The boards are required to make an annual report to the State highway commission. The New Mexico system would appear to be even more centralized than New York so far as the legislation is concerned but will probably prove much more local in the actual working out of the law as the county boards are for the most part expending local funds and not in continuous touch with the State highway officials through the expenditure of State funds as are the local officials in New York.

A decided example of the trend toward centralization is afforded by legislation recently enacted in Iowa which gave to the State highway commission general supervision over all road work in the State. Another example illustrating this trend is shown in the Illinois law whereby the county superintendents are made law deputies of the State highway engineer and have veto power over expenditures in excess of $200 in all townships and road districts.

Local Revenues and Labor Taxes

The system of working out road taxes has been abolished by a great many States in recent years but is still in effect in the States of Alabama, Arkansas, Colorado, Florida, Georgia, Idaho, Illinois, Indiana, Kentucky, Louisiana, Minnesota, Mississippi, Montana, Nevada, New Mexico, North Carolina (partially), Oklahoma, South Carolina, Tennessee, Texas, Wisconsin (partially), a total of twenty-one States. In the remaining twenty-seven States the taxes are paid in cash some of the States levying a cash poll tax as well as property tax and some of the States restricting the taxation to property.

In some of the States the formation of special assessment districts for the construction of roads, is permitted by law.

In Arkansas the law provides that such improvement districts may be formed upon petition of the majority of the property owners. The cost of the improvement is assessed upon the property owners in the district and the work is done by a board of directors composed of three members who receive $3 per diem for days actually employed. In Arizona the law provides such districts not to exceed 10 miles in length and 1 mile in width and permits bonds to be issued by a vote of the electors. The corporate districts is also authorised in Colorado. In Florida special road and bridge districts may be created by election but the special taxes are levied and collected by the county board. Among other States which permit this system are; Illinois, Indiana, Mississippi, Missouri, Montana, and Oklahoma.

Wide Tire Legislation

Wide tire legislation is in effect in a few of the states but has not proven effective owing to the difficulty of enforcing the law. For example a wide tire law of Florida provides that the width of tires on vehicles used to hold heavy loads over improved roads shall be as follows: for a two-horse wagon, 4 inches; for a four-horse wagon, 6 inches; and for a four-horse wagon used to haul heavy logs or stone, not less than 7 inches; the law is subject to adoption by county commissioners of the respective counties. A more practical form of legislation on this subject would be an annual wheel tax which could be remitted upon proof that the tires have a greater width than 4 inches. This would make the law effective as the burden of proving exemption would be upon the tax payer instead of upon the State or county.

LEGISLATION GOVERNING LOCAL BOND ISSUES[1]

Alabama

The court of county commissioners and board of revenue of any county may order an election on the question of issuing bonds of the county for building roads or to pay debts created for the building of roads. After an election is held, another such election shall not be held within one year. A majority vote is necessary to carry. The amount of bonds shall not exceed 3½ per cent of the assessed value of property and shall bear not to exceed 5 per cent interest, shall be sold for not less than par value, and shall run for such time as may be fixed by the court of county commissioners and board of revenue. No specific provision is made by law for retiring such bonds, and this matter presumably is left to the discretion of the court of county commissioners and board of revenue

Arizona

The board of trustees of any road district may, when it is deemed necessary or advisable to expend a larger amount than can be raised by the tax of 75 cents, call an election and submit the question of bonds to the voters of the district. A two-thirds favorable vote authorizes the issuance and sale of bonds, which shall run for not more than twenty years, shall bear interest not exceeding 6 per cent, payable annually, and shall not be sold for less than par. The board of supervisors shall levy a tax sufficient to pay interest and retire bonds at the end of their term, although the board may provide for bonds to be retired serially.

Arkansas

Highway improvement districts may be organized and chartered upon vote of a majority of the electors. If so provided in the charter, the State highway commission, as agent of any such highway improvement district, or such other commissioners as may be designated as such agents in the charter, may issue bonds for terms not exceeding thirty years, with interest at not exceeding 6 per cent per annum. Bonds may be serial or straight terminable bonds with proper provision for a sinking fund. Such bonds shall be a lien upon all real estate in the district, and an annual tax shall be levied to pay interest and principal. No bonds shall be sold for less than par.

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[1] From data supplied by U. S. Office of Public Roads.

California

Upon petition of a number of freeholder electors of any county equal to 10 per cent of the last vote cast for governor, praying that the issuance of bonds for highway purposes be submitted to the electors, the county supervisors may appoint a highway commission of three members for such county to investigate the main roads and report to the board of supervisors those roads that should be improved, their estimated cost and the amount of bonds to be issued. If this report is approved by the board of supervisors, an election on the issuance of the bonds shall immediately be called. A two-thirds majority vote of the qualified electors is required. The term and rate of interest is not specified in the act. All work done with the proceeds of the bond issue shall be under the direction of the highway commission.

The county supervisors of any county may create road districts under two different acts. *A permanent road district* (act of March 19, 1907) may be created upon the petition of a majority of the land owners of the proposed district, who may, in their petition, propose a bond issue for certain road improvements, and this bond issue shall be submitted by the supervisors to the electors of the district, and if two-thirds of the votes cast are favorable, then bonds of the district shall be issued not to exceed 15 per cent of the assessed valuation, to run not to exceed twenty years, and to bear interest at not to exceed 7 per cent per annum. The bonds shall be sold to the highest bidder at not less than par, and the work authorized shall be done by contract to be let to the lowest responsible bidder. *A special road district* (act of March 21, 1913), for certain specified improvements on established roads may be created by the county supervisors after giving notice of the proposal, if a majoroity of the land owners of the proposed district do not file objections thereto prior to the date set for hearing objections. Upon the creation of the district, contracts under the approved specifications shall be awarded to the lowest responsible bidder and, upon the completion and acceptance of the work, bonds of the district shall be issued to pay for this work, to run not to exceed twenty years, and bear interest at not to exceed 7 per cent per annum. Under both acts a tax shall be levied to pay interest and principal when due, although in the case of bonds issued by a special road district the county supervisors may make tranfers of funds for the payment of interest and principal when due.

Colorado

When the county commissioners of any county shall deem it necessary to create a county indebtedness for road and bridge purposes, they may submit the proposition to a vote and, if a majority of the votes cast are in favor of the proposition, they may issue bonds of the county in the aggregate not to exceed the following: Counties of assessed valuation over $1,000,000 and less than $5,000,000, $2 on each $1000; and counties of assessed valuation over $5,000,000, $6 on each $1000. These bonds shall bear interest not exceeding 10 per cent per annum and shall be payable at the pleasure of the county after ten years, but absolutely due and payable twenty years from the date of issue. To pay the interest on such bonds, an annual tax shall be levied by the county commissioners, and for their ultimate redemption the county commissioners shall levy annually, after ten years, a tax upon all taxable property in the county in such an amount as to create a yearly fund equal to 10 per cent of the whole amount of the bonds. The proceeds of these bonds shall be used only for the purpose for which they were issued.

Connecticut

No general road bonding law.

Delaware

No general road bonding law.

Florida

Upon a petition of 25 per cent or more of the registered voters or freeholders residing in any territory embraced wholly or in part in one or more road districts, praying that this territory shall constitute a special road and bridge district for the purpose of improving roads and bridges therein by the levy and collection of special road and bridge taxes or by the issue and sale of bonds, the board of county commissioners shall order an election thereon, and a favorable majority vote shall be necessary to authorize this arrangement. If, at this election, bonds are authorized to pay for such improvement, the board of county commissioners shall issue and sell these bonds and levy an annual tax to pay the interest and create a sinking fund for their redemption.

Georgia

No general road bonding law.

Idaho

There are in Idaho two classes of road districts that are authorized by law and may issue bonds. Since 1905 it has been lawful for any portion of a county containing twenty-five or more resident taxpayers, by a majority vote of the resident freeholders at an election ordered by the county board of commissioners and petitioned for by a majority of the freeholders, to organize and become a good roads district. Three good roads commissioners are also chosen at this election, who are authorized, with the consent of two-thirds of the qualified freeholders expressed at an election, to issue bonds in any amount not exceeding 25 per cent of the assessed real property valuation in the district, and the proceeds must be used exclusively for road purposes. These bonds shall bear interest not to exceed 6 per cent, shall run for not more than twenty years, and shall not be sold for less than par.

Under an act of 1911, fifty or more freeholders of lands wholly within a county aggregating 20,000 acres or consisting of less contiguous territory that has an assessed valuation of $1,000,000, provided that these freeholders own at least 10 per cent of all the property in the proposed district, or a number of resident freeholders equal to 20 per cent of the last vote cast for governor may petition the county board of commissioners for an election at which the majority vote decides. If the vote is favorable, a highway district is organized with three highway commissioners, with terms of four years each, and the first of these commissioners are appointed by the governor, while their successors are elected. The commissioners constitute a highway board and have authority by resolution to issue coupon bonds for road purposes at not exceeding 6 per cent interest, and payable within twenty years by sinking fund provided therefor. If these bonds increase the outstanding bonded debt of the district, the resolution shall provide for an election, and a two-third vote is necessary to carry the election. In highway districts the amount of the bond issue shall not exceed 10 per cent of the assessed valuation of all property in the district

A good roads district may become a highway district in the same manner as any unorganized territory.

Illinois

If the highway commissioners in any township in a county under township organization or in any district in a county not under township organization desire to expend on any bridge or other distinct and expensive work on the roads a greater sum than is available, they may call a special election to decide on the issuance of bonds. If a majority of the legal voters voting at such election shall favor the bond issue, the commissioners and town clerk or district clerk shall issue from time to time, as the work progresses, a sufficient amount of bonds for the purpose of building the bridge or other construction. These bonds shall bear not to exceed 5 per cent interest and shall be of such denominations and upon such time as the necessities require. They shall not be sold for less than par and the town or district must provide for their payment by appropriate taxation. Likewise, a petition signed by the highway commissioners and one hundred freeholders may be addressed to the town clerk requesting an election to determine whether the town shall borrow funds to construct or maintain gravel, macadam, or other roads. A majority vote shall cause the bonds to be issued under the same provisions as above: Provided that the amount to be voted upon, including principal and interest, shall not exceed the amount which can be raised during a period of five years by an annual levy of $1 on each $100 of taxable property.

Indiana

County commissioners are authorized, when requested by a petition signed by fifty freeholders, to grade, drain and pave with "stone, gravel or other road paving material" new or existing highways in any township or on the line dividing two or more townships, and to issue 5 per cent county bonds not to exceed the contract price of the improvements, nor in excess of 4 per cent of the assessed valuation of the town or townships including bonds already issued. The bonds must be in denominations not less than $50 and payable in semiannual series in not less than ten nor more than twenty years. The bonds are retired by an annual tax levied by the commissioners on all the property of the townships affected. Complete plans and specifications for all improvements are made before the election is ordered by a competent civil engineer and two viewers appointed by the commissioners.

For the same purposes as above, gravel road assessment bonds may be issued by county commissioners when petitioned by a majority of the resident landowners within one mile of the proposed improvement. The bonds are paid off by assessment upon the property in proportion to the benefits derived from the improvement.

For the purchase of toll roads, the county commissioners may issue bonds not exceeding 4 per cent of the payable assessed valuation in annual series for not more than twenty years, and bearing interest not exceeding 6 per cent.

All highway bonds bearing interest not exceeding 4½ per cent are exempt from taxation.

Iowa

No general road bonding law.

Kansas

Upon petition of 60 per cent of the landowners who own at least 50 per cent of the land to be taxed, naming the road, the terminal points of improvement, the kind of improvement, and the number of assessments, not exceeding ten, to be made in payment thereof, the county board shall improve this road if it is found and declared to be of public utility.

The county commissioners are empowered to make contracts. In payment for any work or material, these commissioners shall issue special improvement bonds, bearing interest not exceeding 6 per cent and payable within the time or times mentioned in the petition.

Three-fourths of the cost of the improvement shall be apportioned among the property owners within the radius described in the petition and shall be collected as other taxes. One-fourth shall be charged to the township or townships in which the improvement is made and this amount shall be raised in the same manner as provided by law for raising taxes for all purposes: Provided that this act does not apply to the construction or improvement of roads costing less than $500 per mile.

Bridge bonds in any sum not in excess of 1 per cent of the taxable property may be issued by the board of county commissioners of any county, the mayor and council of any city, and the trustee, clerk, and treasurer of any township, upon a majority vote at an election called by a petition signed by two-fifths of the voters of their respective political division.

The bonds shall be in denominations of not less than $100, shall bear interest not exceeding 10 per cent, and shall run for not less than five, nor more than thirty years.

Kentucky

On the petition of 150 voters and freeholders of a county, the county court shall call an election to determine whether bonds of the county shall be issued in an amount not to exceed 2 per cent of the taxable valuation of the county. If two-thirds of the legal voters who vote shall favor the bond issue, the fiscal court may issue bonds to bear not exceeding 6 per cent interest, to run not more than thirty years, and to be retired, interest and principal, by the proceeds of a tax not exceeding 20 per cent on the $100.

Louisiana

Municipal corporations, drainage districts, or parishes may issue bonds for the purpose of improving the roads therein. Before these bonds are issued, the question shall be submitted to an election and a majority in number and in the amount of property valuation of the actual votes cast shall be necessary to carry the election. Bonds shall not be issued for a greater amount than 10 per cent of the assessed valuation, shall bear not exceeding 5 per cent interest, and shall run not to exceed forty years. A sinking fund shall be provided to redeem these bonds at maturity and an annual tax imposed to create this sinking fund and pay the interest on the bonds annually. Such bonds shall be sold for not less than par, and the proceeds thereof shall not be used for any other purpose than that for which they are issued.

Maine

No general road bonding law.

Maryland

No general road bonding law.

Massachusetts

No general road bonding law.

Michigan

The township board of any organized township, upon petition of at least twenty-five freeholders thereof, may submit to an election the proposition of issuing bonds of the township in an amount not exceeding 5 per cent of the assessed valuation thereof, for improving the roads therein under the commissioner of highways, subject to direction of the township board a majority of the legal voters voting is necessary to authorize the bond issue. These bonds shall bear not to exceed 5 per cent interest and shall run not to exceed twenty-five years, and a tax shall be levied annually to meet the interest and principal as fast as they become due.

Counties that have adopted the county road system may issue bonds to pay for such improvements as the commissioners of highways decide to make, in an amount not exceeding 3 per cent of the valuation of property assessable for this purpose. Before issuing these bonds, the county board of supervisors must order an election to decide on the issue upon petition signed by twenty-five resident freeholders. A majority of votes cast is required to authorize the bond issue. Bonds shall not be sold for less than par and shall run for not exceeding twenty years. The rate of interest and method of payment are not specified.

The county board of supervisors in counties that have not adopted the county road system may, without petition from freeholders, submit to a vote the question of issuing bonds of the county for road purposes.

Minnesota

On petition of 50 or more voters who are freeholders of the county, the county commissioners may submit to vote the proposition of issuing county bonds for road purposes. If a majority of those voting are in favor of the proposition, the county board shall issue bonds of the county in such amount as will not, with existing indebtedness, make the total indebtedness of the county exceed 15 per cent of the assessed valuation of taxable real property therein. These bonds shall bear not to exceed 6 per cent interest, shall have coupons attached, and shall be paid in equal installments—the first to become due and payable not less than five years after the date thereof, and the last not more than twenty years after such date.

The town board, to make extraordinary improvements that will cost more than the town is otherwise authorized to appropriate, on petition of 15 or more voters of the town owning real estate therein, may submit the question of the improvement to the next annual town meeting, or, if so requested, may call a special town meeting to vote on the question, and a 60 per cent majority vote shall authorize the improvement. The town board may then issue bonds of the town to raise the necessary funds. The amount of these bonds, with the existing indebtedness of the town, shall not exceed 5 per cent of the assessed valuation thereof. Such bonds shall bear not to exceed 6 per cent interest, shall have coupons attached, and shall be due in ten equal installments, the first of which shall become due and payable not more than eighteen months after date, and one each consecutive year thereafter. A tax shall be levied to pay the interest and principal of such bonds as they become due.

Mississippi

For the purpose of road and bridge improvement, the county board of supervisors may issue bonds of the county to an amount not exceeding, including all of its bonded indebtedness, 5 per cent of the assessed valuation of all taxable property in the county. These bonds shall run not exceeding forty years, shall bear interest at the rate of 6 per cent, and shall be redeemed by a sinking fund to be provided for that purpose by annual taxation.

Supervisor districts may issue bonds for road purposes on petition to the county board of supervisors signed by 20 per cent of the qualified electors of the district. A favorable vote by a majority of those voting at an election to be called for that purpose is necessary to authorize the issue. These bonds shall run not exceeding twenty-five years, shall bear not exceeding 6 per cent interest, shall be exempt from taxation, and shall be sold for not less than par. A tax shall be levied annually to pay the interest and create a sinking fund for the discharge of such bonds at maturity.

Missouri

When petitioned by 100 tax-paying citizens of any county, the county court thereof may submit to a vote the question of issuing bonds for road and bridge purposes, and a two-thirds majority vote of those voting is required to authorize the bond issue. Such bonds shall be coupon bonds and issued in such amount as will not, with the existing indebtedness of the county, exceed the constitutional limitation of 5 per cent of the assessed valuation of the taxable property therein; they shall bear not to exceed 5 per cent interest, shall be exempt from taxation, and shall mature and be payable within 20 years upon the call of the county court. The principal sinking fund and interest of these bonds shall be paid by a tax levied for this purpose.

Special road districts may be organized and the board of commissioners thereof may call an election to determine whether bonds shall be issued for road purposes. A two-thirds majority of those voting shall be necessary to authorize the issuance of these bonds, which, if issued, shall be in an amount, including existing district indebtedness, not to exceed 5 per cent of the assessed valuation of the district. The bonds shall bear not exceeding 6 per cent interest, shall become due in not exceeding fifteen annual installments, the first of which shall become due not later than two years after the date of the bonds. The bonds shall be sold to the best advantage by the board of commissioners.

Montana

The board of county commissioners of any county may issue coupon bonds in an amount which, with the outstanding bonded indebtedness, will not exceed 5 per cent of the assessed valuation of the taxable property therein; provided that no county shall incur any indebtedness or liability for any single purpose to an amount exceeding $10,000, without the approval of a majority of the electors thereof.

Nebraska

Any county, township, precinct, city, or village may issue bonds to construct a highway bridge across any boundary river of the State, if so voted by three-fifths of the voters at a special election. The amount of bonds must not exceed 10 per cent of the valuation. In any county, township, precinct, city or village which has made donations to railroads or other internal improvements, a two-thirds vote shall be required for such bonds. The interest shall not exceed 7 per cent. There shall be an annual tax for interest and sinking fund. The term of the bond is not designated.

Similar provision is made for purchasing private bridges within any township or across any river bounding a township. For such purpose a two-thirds majority is required and the bonds shall bear not to exceed 8 per cent interest. A yearly tax must be levied to pay 5 per cent of the principal annually and the interest on the bonds. Any county or city in the State is authorized to issue bonds for internal improvements, and it appears that such improvements include highways.

Nevada

On a majority vote of the qualified electors of any county, the board of county commissioners may issue bonds of the county to create a fund to be known as the "county road and bridge fund," to be used in the construction, repair, and maintenance of the county roads and bridges, and the purchase of necessary implements and machinery for this purpose. The amount of these bonds shall not exceed the equivalent of 3 per cent of the total assessed valuation of the real and personal property in the county. The bonds shall have interest coupons attached, shall bear not to exceed 6 per cent interest, shall be in denominations of $1000, $500 or $100, as determined by the board of county commissioners, and shall be numbered consecutively from first to last, and must not be sold for less than par. On January 1 of the third year succeeding their sale and annually thereafter, one or more of these bonds, as shall be designated by the board, in consecutive order, shall be paid and redeemed by the county, and an annual tax shall be levied to pay the interest on them and to create a sinking fund for their retirement.

New Hampshire

No general road bonding law.

New Jersey

The board of chosen freeholders may issue bonds of the county in an amount, including existing indebtedness, not exceeding 3 per cent of the assessed valuation of the real estate therein; provided that in no case shall the amount of such bonds outstanding at any one time exceed $300,000. These bonds shall bear interest not to exceed 5 per cent, and shall run presumably for forty years. Before issuing the bonds, the board of chosen freeholders shall make application in writing to the circuit court of the county for authority to issue the bonds, and the circuit court shall investigate and determine whether the bonds shall be issued.

The board of chosen freeholders of a county, or the township committee of a township, or the proper governing body of other municipality, may, by resolution, issue bonds thereof to pay the share of the county, township, or other municipality in the cost of State-aid road work therein. These bonds shall bear not exceeding 5 per cent interest and shall run not exceeding thirty years (except bonds issued to provide funds for extraordinary repairs or reconstruction which shall be payable in not exceeding five years), and an annual tax shall be levied sufficient to pay the interest on the bonds and to provide a sinking fund for the retirement of such bonds at maturity.

New Mexico

When petitioned by not less than 10 per cent of the qualified electors of the county who are taxpayers, the board of county commissioners may submit the question of issuing bonds of the county for road purposes. A majority of those voting is required. The amount of the bonds shall not exceed in the aggregate, including existing indebtedness, 4 per cent on the value of the taxable property within the county, shall bear not to exceed 5 per cent interest, and shall run not to exceed thirty years, but may be made redeemable prior to the date of their maturity, as may be provided by order of the board of county commissioners. An additional annual tax levy shall be made to meet the interest charges on the bonds, and there shall be created a fund to be known as the "county highway sinking fund," which shall be used for the redemption of bonds so issued.

New York

The county board of supervisors may, by resolution, authorize the issuance and sale of bonds for paying the county's share of the cost of any highway. These bonds must not be sold for less than par, and the amount of the issue must not increase the total county indebtedness to more than 10 per cent of the assessed valuation.

For the purpose of purchasing toll roads and bridges, the county board may issue bonds which shall bear interest not exceeding 5 per cent, shall run not longer than twenty years, and shall not be sold below par.

Towns may issue bonds for road purposes when authorized by the county board of supervisors. In the case of towns, a majority vote may increase the amount of issue to one-third of the assessed valuation of the town.

North Carolina

Upon presentation of a petition by not less than one-fourth of the qualified voters of any township to the board of county commissioners, the board shall within thirty days order an election in the town to determine if bonds shall be issued. This election shall be held subject to the rules and regulations of the general election laws of the State, and a majority vote of the qualified voters shall be necessary. Such elections shall not be held oftener than every twelve months. The amount of bonds that may be so issued shall not exceed $50,000 for any one township in any county, and the bonds shall be paid by the township for which they are issued, and shall not be chargeable against any property or polls outside of the township. These bonds shall be coupon bonds, shall bear not to exceed 5 per cent interest, and shall be sold for not less than par value, and the interest and sinking fund charges shall be met by appropriate annual taxation. The fund raised by this taxation in excess of the amount required to pay interest shall be safely invested by the board of commissioners and the county commissioners are authorized to purchase any of these bonds to the amount of this excess annually, and after ten years they may purchase at a sum not exceeding par value, one-twenty-fifth of the bonds issued for any township.

North Dakota

Section 183 of article 12 of the constitution authorizes counties, townships, cities, towns, or other political subdivisions to create an indebtedness not to exceed 5 per cent of the assessed valuation of the taxable property therein, but apparently there has been no general statutory enactment permitting the creation of an indebtedness for road purposes under authority thus conferred.

Ohio

Authority is conferred upon township trustees to issue bonds of the township in denominations of $500 to bear not exceeding 6 per cent interest per annum, to run not exceeding thirty years, and to be sold for not less than par, and the aggregate amount of such bonds which may be outstanding at any one time is not to exceed $50,000. Not more than 5 miles of road may be improved in any one year, and no more bonds shall be issued than shall be required to pay the cost of such improvements for the current year. A tax of not exceeding 3 mills on the dollar of all taxable property in the township shall be levied each year until the interest and the principal of the bonds are paid.

The township trustees of a township may create a road district and may issue the bonds of the road district to bear not exceeding 5 per cent interest per annum, and to run not exceeding twenty years, and the amount of bonds that may be outstanding at any one time is not to exceed $100,000. Before these bonds shall be issued, the proposition shall be submitted to a vote of the qualified electors of the district.

In any county, adjacent townships, not exceeding four, may be organized into a road district to improve the roads. When the construction of such a road district is petitioned for by at least fifty resident taxpayers of each of the townships, a road commission of not more than one member from each township, shall be nominated by the township trustees and appointed by the county commissioners. These road improvements must be indorsed by the qualified voters of the district at an election to be held for that purpose. The road commission may issue bonds to run not exceeding 15 years, to bear not exceeding 6 per cent interest, to be sold for not less than par value, and not to exceed, in the aggregate, $250,000 to be outstanding at any one time, unless the taxable valuation of the district shall exceed $5,000,000, when $25,000 additional bonds may be issued for each million of assessed valuation over $5,000,000. To meet the interest and principal of such bonds, the county commissioners shall levy on all taxable property in the district an additional tax of not to exceed 3 mills on the dollar.

In addition, there are numerous special provisions of law under which county commissioners may issue county bonds, and township trustees may issue township bonds for road improvement purposes.

Under the act approved May 31, 1911, as amended in 1913 providing for State aid in the construction of "inter-county highways, etc.," the county commissioners of any county are authorized to issue bonds in anticipation of collections of revenue from the assessment of a special tax for the purpose of constructing, improving or repairing roads under the act, and obtaining State aid therefor. Such bonds shall state the purpose for which they are issued, and shall bear interest not to exceed 5 per cent per annum, payable semiannually, and mature not later than ten years from the date of issue, as the county commissioners shall determine, provided the aggregate amount of these bonds shall not exceed 1 per cent of the tax duplicate of the county. The bonds shall be advertised in two newspapers published in the county at least once each week for four consecutive weeks, and shall be sold to the highest bidder at not less than par and accrued interest, and the county commissioners may reject any and all bids. The proceeds of such bonds shall be used exclusively in constructing, improving, maintaining or repairing the road for which they were issued, except that any unexpended balance shall become a part of the general road funds of the county.

Oklahoma

The township board may issue bonds in an amount not exceeding 3 per cent of the taxable property upon a three-fifths vote at a special election. The bond interest shall not exceed 6 per cent and the term shall not exceed twenty-five years. An annual tax shall be levied to pay the interest and to create a sinking fund for the redemption of the bonds at their maturity.

The county commissioners of any county are authorized, upon a three-fifths vote of those voting at a special election, to issue county bonds for building, repairing or acquiring bridges, and the term of the bonds shall not exceed twenty-five years and their interest shall not exceed 5 per cent. An annual tax is levied to meet the interest and sinking fund charges on the bonds.

Road improvement districts of not less than 8 square miles in area may be created in any county upon written petition signed by 15 per cent of the qualified electors of the proposed district, filed with the county clerk. Such petition shall ask for a vote on the bond issue for the improvement of the roads in the district, and at the election a three-fifths majority of those voting shall be required to authorize the issuance of bonds. Interest on these bonds shall not exceed 5 per cent, and the term shall not exceed twenty-five years. The board of county commissioners shall annually levy upon all the taxable property in the road improvement district a tax sufficient to pay the interest on the bonds and to create a sinking fund for their redemption.

Oregon

A proposition to issue county road bonds may originate in either of four ways: First, upon the petition of the registered voters equal to one-fourth of the greatest number of votes cast for any candidate for judge of the supreme court at the last general election in that county, or by 5000 registered voters, the county court *shall* submit a proposition to issue county road bonds at a special election called for that purpose; second, upon the petition of one-twentieth of the registered voters, as above, the proposition *may* be submitted at a special election; third, upon the petition of one-tenth of the registered voters, as above, the proposition *shall* be submitted at the next general election; and fourth, the county court *may* submit the proposition at any general election of its own motion.

Upon a favorable vote of the majority of all those voting at the special or general election, the county court shall issue the road bonds or the county warrants in lieu thereof, as funds are needed. The bonds shall be issued in denominations of not less than $50 nor greater than $1000, and shall bear interest not to exceed 6 per cent. The aggregate of all bonds outstanding shall not exceed 2 per cent of the assessed valuation, and shall be sold to the highest bidder. The proceeds shall be expended only in constructing permanent public roads as specified in the order submitting the proposition. A special tax may be levied to pay interest charges, and to provide a sinking fund for the payment of the principal, or provision therefor may be made by transferring funds to such sinking fund.

Pennsylvania

The county commissioners of the several counties may borrow money for improving and maintaining the public roads, and may issue bonds for these improvements. The amount shall not exceed in the aggregate 2 per cent of the total of the assessed valuation of all property in the county at the last triennial valuation; but, no such bonds or indebtedness shall bear interest exceeding 5 per cent. The county commissioners shall not issue bonds in one year to exceed one-half of 1 per cent of the total valuation of all property, as shown at the last triennial assessment; provided, that the amount of bonds issued in any one year in excess of one-tenth of 1 per cent of such total valuation of all property shall be approved by the grand jury and court of quarter sessions.

Rhode Island

No general road bonding law.

South Carolina

No general road bonding law.

South Dakota

It is provided in article 25, section 1137, of the revised code of 1903, that the boards of supervisors of organized townships are authorized to issue coupon bonds when directed by a two-thirds majority of the voters, at a town meeting called for that purpose. Under the amendment of 1911, chapter 250, these bonds or orders are to be payable in such amounts and at such times, not exceeding ten years from date, as two-thirds of the legal voters present and voting shall determine, with interest not exceeding 6 per cent per annum, payable annually. The section of the original article agrees with this amendment in its provision that the above action may be taken at an annual town meeting duly advertised.

Section 1139 of the original act provides that the board of supervisors must levy a tax for interest and principal not exceeding 15 per cent of such maturing bonds, and section 1140 of the original act provides that whenever a petition bearing the signatures of two-thirds of the legal voters of a township asks that an amount of money not exceeding 5 per cent of the taxable valuation of the town and not exceeding $5000 be raised for the construction of any public road or roads, the supervisors shall issue and sell coupon bonds for the amount specified. The term shall not exceed twenty years and the interest shall not exceed 10 per cent, payable annually, and these bonds are to be sold for not less than par value. The interest and principal are to be provided for by taxation. Money so obtained is to be used under the direction of the supervisors of the town involved.

Tennessee

Under an act approved September 27, 1913, the county court of any county, when authorized by a majority vote at an election held for the purpose, may issue coupon bonds for highway purposes in any amount which will not increase the outstanding indebtedness of the county to more than 10 per cent of the taxable valuation. These bonds shall bear interest at not exceeding 6 per cent, shall not run for more than forty years, and shall not be sold for less than par; provided that a two-thirds vote may authorize a bond issue that may increase the outstanding indebtedness to an amount not to exceed 15 per cent. The county court provides the levy for interest and retiring the bonds and also for creating an annual maintenance fund equal to 2 per cent of the bond issue.

In case of federal aid, the court is authorized to appropriate an amount not to exceed double the federal aid, and, in case there are insufficient funds in the treasury, may issue bonds not to exceed 3 per cent of the taxable valuation.

The county court must adopt a resolution setting forth the roads to be built or improved and the number of miles thereof, and may authorize the expenditure for the employment of engineers and payment of expenses incident to the preparation and preliminary plans for the improvement to be made under this act.

The county court shall have the right to divide the county into districts (not less than three nor more than eight) and there shall be elected one road commissioner from and for each district; provided that any county not desiring districts shall have the right to elect three commissioners at large who shall constitute the county board of commissioners.

The commissioners shall let all work for grading, macadamizing, concreting, bridge building, etc., by contract. They shall employ an engineer to lay out and estimate the cost of the improvement and supervise the work done under this act.

Texas

Any county, political subdivision, or other defined district of the county, upon a vote of two-thirds majority of the resident, property-holding taxpayers, may issue bonds for road purposes in an amount not to exceed one-fourth of the assessed value of the real property therein. These bonds shall run for not less than twenty nor more than forty years, with such option of redemption as may be fixed by the commissioners' court, shall bear not more than 5½ per cent interest per annum, and must be examined by the attorney general and registered by the state comptroller of public accounts. The county commissioner's court shall levy a tax sufficient to pay the interest on these bonds and produce a sinking fund sufficient to redeem them at maturity. Each political subdivision or defined district so issuing bonds shall be made a body corporate, and may sue and be sued in like manner as counties. The county commissioner in whose precinct the political subdivision or defined district is located shall be ex-officio road superintendent of the road district, with power to contract for and on behalf of it.

Utah

The board of county commissioners may contract bonded indebtedness by an order specifying the purposes for which the indebtedness is to be created and the amount of the indebtedness, and by providing for submission of the proposition to the electors of the county at the next succeeding general election, or at a special election to be called for that purpose. At this election only such qualified voters as have paid a property tax in the county in the year preceding the election shall be permitted to vote on the question of issuing bonds. A majority of those voting shall be necessary to authorize the issuance of bonds. If the bonds are issued, the board shall levy a tax necessary to pay the interest on them and to create a sinking fund for their redemption at maturity. Bonds shall not be in an amount which, including existing indebtedness, will exceed 2 per cent of the value of the taxable property of the county.

Vermont

Any town or incorporated city may issue bonds to an amount not exceeding three times its grand list for the purpose of purchasing road-making apparatus and building permanent highways therein. To authorize such bonds a two-thirds majority vote of all those cast at a meeting of the town or corporation for that purpose shall be necessary. These bonds shall be issued for a term not exceeding twenty-five years, with interest coupons attached bearing not to exceed 5 per cent interest. The town, city or village must by vote determine the time, place, manner of payment, and the terms, denominations and conditions of such bonds.

Virginia

Upon the petition of a majority of the board of supervisors of any county or upon the petition of 150 freeholders of a county to the circuit court thereof, the circuit court may order an election to determine whether the board of supervisors of the county shall issue county bonds for road purposes. A majority of the qualified voters of the county will be necessary. The amount of the bonds, including all bonds previously issued and remaining unpaid, shall in no case exceed 10 per cent of the total taxable value of the county. These bonds shall be issued in denominations of $100 or some multiple thereof, shall bear not to exceed 6 per cent interest, and shall be payable not exceeding thirty-four years from the date thereof, but may, in the discretion of the board of supervisors, be made redeemable at such time or times as the board may prescribe and stipulate upon the face of the bonds when issued. After the issuance of the bonds, a tax shall be levied in the county on all property liable to State tax to an amount sufficient to meet the interest on the bonds and create a sinking fund for their redemption at maturity.

The board of supervisors, or local county road board if there be one, shall apply to the State highway commissioner for, or shall employ a competent road engineer to make plans and specifications for and supervise the improvements made from the proceeds of the bond issue.

Bonds may be issued by any county for the purpose of macadamizing or otherwise improving the public roads and bridges of any magisterial or road district in such county. Before the bonds are issued, a petition signed by a majority of the board of supervisors of the county or by fifty freeholders of any magisterial district or districts in the county shall be presented to the circuit court of the county, which shall order an election to be held to determine whether the bonds shall be issued. A majority of the qualified voters of the district voting thereon shall be necessary to carry the election. The amount of these bonds shall not exceed 10 per cent of the total assessed taxable values at the time in the magisterial district. These bonds shall be in denominations of $100 or some multiple thereof, shall bear not exceeding 6 per cent interest per annum, and shall be payable within not exceeding thirty-four years from the date thereof, but may, in the discretion of the board, be made redeemable at such time or times and upon such notice as the board may prescribe and stipulate upon the face of the bonds when issued. The necessary tax levy shall be made by the board on all taxable property liable to State tax in the magisterial district, in order to meet the interest on the bonds and to create a sinking fund for their redemption at maturity.

Under a clause in article 5 of chapter 76 of the laws of 1908, when more than 50 per cent of the expense of permanent road improvement in any county is expended in accordance with provisions of the act, that county shall be entitled to receive its annual apportionment of State aid until its receipt from the State on that account shall equal 50 per cent of the expense.

Washington

There are in Washington three operative statutes passed and effective in the years 1890, 1893 and 1913, respectively. The last two are very similar, and the act of 1913, as therein stated, is intended to confer additional power and authority. Bonds may be issued under the provisions of either of these statutes.

The board of county commissioners of any county may, by the act of 1890, whenever a majority of them shall so decide, submit to an election the question of issuing coupon road and bridge bonds in an amount not to exceed 5 per cent of the taxable property in the county, bearing not to exceed 6 per cent interest per annum, and payable at such time as may be fixed by the board of county commissioners. This proposition may be submitted at a general election and a majority of three-fifths of the votes cast is necessary to authorize the issue of these bonds. If bonds are issued, the county commissioners must ascertain and levy annually a sufficient tax to pay the interest on them when they become due and to create a sinking fund to redeem them at maturity.

The county commissioners are authorized by the act of 1893 to establish and construct a system of improved roads on petition setting forth that the public welfare requires that such improvements should be begun without delay and that the county has not sufficient funds. If the commission shall approve the petition, they may by resolution direct that an election be called on the question of issuing bonds of the county to provide funds. If three-fifths of those voting are favorable, the commissioners shall issue the bonds and negotiate their sale at not less than par value. These bonds shall be made payable to the bearer within not more than twenty years from their date and shall bear not exceeding 6 per cent interest. Bonds shall not be issued under the provisions of this chapter in such an amount as will make the aggregate indebtedness of the county exceed 1½ per cent of the value of taxable property therein. When bonds are issued, the board of county commissioners is authorized and required annually to levy and collect a tax sufficient to pay the interest on them, and, in case they are to run longer than ten years, they shall annually levy and collect, beginning with the annual tax levy succeeding the expiration of ten years from the date of the bonds, an additional tax to provide a sinking fund for the payment of the principal thereof. This annual sinking fund levy shall be at least equal to 10 per cent of the amount of the bonds issued.

An act passed in 1913 authorizes the board of county commissioners of any county to submit to the voters of the county the question of issuing negotiable coupon road bonds in an amount not to exceed 5 per cent of the taxable property of such county. This question may be submitted at the general election or at a special election called for that purpose. A three-fifths majority of the votes cast shall be necessary to authorize the issuance of the bonds. If issued, they shall run not to exceed twenty years and bear not to exceed 6 per cent interest. The provisions of this act shall apply not only to roads which are or shall be under the general control of the county, but also to all parts of the State roads in the county and to all roads which are situated or are to be constructed wholly or in part within the limits of any incorporated city or town therein; provided that the board of county commissioners finds that they form or will become a part of the public highway system of the county; provided further that no proposition for bonds shall be submitted which proposes that more than 40 per cent of the proceeds thereof shall be expended within any city or town or within any number of cities and towns. After the bonds are issued, the county commissioners shall levy an annual tax sufficient to pay the interest and at least five years prior to the maturity of the bonds, and thence forward each year until their maturity the county commissioners must ascertain and levy a tax sufficient to accumulate during the last series of years a fund equal to the principal of all the bonds then remaining outstanding and unpaid. The proceeds of this tax shall go into a sinking fund for the discharge of the bonds.

West Virginia

The county court of any county may improve the main roads thereof, and may pay for them by the issuance of the bonds of the county. In this case the court, upon petition of fifty legal voters of the county, shall submit the proposition at a general school or special election, and a three-fifths favorable vote of all votes cast shall be necessary to authorize the issuance of the bonds. The amount of bonded indebtedness that may be outstanding at any one time shall not exceed 5 per cent of the value of the taxable property within the county. Interest on these bonds shall not exceed 6 per cent, and the bonds shall be sold at not less than par. The term not exceed thirty-four years, and an annual tax shall be levied on all property subject to taxation in the county sufficient to meet the interest and to create a sinking fund for the redemption of the bonds at maturity.

In like manner the county court may issue road bonds of any magisterial district within the county.

Wisconsin

Any county, through its board, may issue nontaxable coupon bonds bearing interest at 5 per cent, payable semiannually, for the original improvement of any portion of the system of prospective State highways. The bonds may run not to exceed ten years, and the entire issue, when added to other county indebtedness, must not exceed 5 per cent of taxable property, as ascertained by last assessment. The bonds may not be sold below par outside of the county until the residents of the county have had a reasonable opportunity to purchase them, and when sold, the proceeds must be apportioned to the respective towns by the county board. The form of the bonds is to be approved by the State highway commission, and the bonds are to be printed from plates furnished by the commission.

The bonds are to be divided as to denominations and due dates so as to have an equal amount payable each year. The interest and principal are provided for by a direct tax to be assessed by the county board. Provision is also made for the issuance of bonds conditioned upon the payment of all interest by private subscriptions, but money or approved securities must be first deposited to secure the payment of this interest. State aid may be obtained upon proceeds from bond sales not to exceed one-half of the tax levy in the county for the payment of the face of the bonds.

No bond issue shall be authorized for more than one-fifth of 1 per cent of the assessed value of all the taxable property in the county until the proposition has been submitted to a vote of electors of the county, and a majority of those voting have been favorable. A petition signed by qualified electors equal to 10 per cent of the number of votes cast for governor at the last general election may secure the submission to a vote of any proposition to issue bonds.

Any town may issue bonds for the original improvement of any portion of the system of prospective State highways in a manner similar to that of the county, except that the proposition must, without exception, be submitted to a vote of the qualified electors of the town at a regular town meeting, or at a special meeting called for the purpose. The rate of interest and other terms of the bonds are practically identical with those of the county.

Wyoming

The State constitution authorizes the county and subdivisions thereof to create indebtedness not to exceed 2 per cent of their taxable valuation, but there has been no statutory enactment, either general or special, under the authority thus conferred, for the issuance of road bonds.

DIGEST OF CONVICT LABOR LAWS

Alabama

The convicts of any county or municipality may be worked upon the public roads, bridges or ferries of the county under the direction of the court of county commissioners, or they may be hired to contractors.

Arizona

The State board of control may cause persons convicted of crime and placed in the state prison to be employed in the construction and maintenance of State roads and bridges. Such prison labor shall conform to directions and specifications of the State engineer, and shall be performed in the several counties only when requested by the county supervisors thereof. The board of control and the State engineer are clothed with ample authority for the effective administration of this act.

Arkansas

The department of State lands, highways and improvements shall employ as many of the State convicts on the public roads as may not be otherwise employed by the penetentiary authorities, the expenses to be borne by the county or improvement district in which they work.

County convicts may be worked upon the highways of the county, and it is lawful to provide in any highway charter for working the male county convicts upon the highways of the county. In case such district is not coextensive with the county from which they come, the county court shall first approve the provision. Special improvement districts may use convict labor and pay a flat rate of 75 cents to the county.

Colorado

At the request of the board of county commissioners the warden of the State penitentiary shall detail such a number of prisoners to work on the public roads as he shall deem proper. The additional cost of guarding and other expense must be borne by the county.

Connecticut

Convict labor on highways is not provided except work for a day or two on roads of town in which county jail is located.

Delaware

In the counties of Kent and Sussex, vagrants and minor criminals may be sentenced to hard work on the county roads.

In New Castle County, the levy court is empowered to arrange for employing any of the able bodied convicts on the public roads.

Florida

The county commissioners may employ all convicts in jail under sentence for crime at labor upon the streets of cities and towns or upon roads, bridges and public works; or the board may hire out convicts. There is no provision for working state convicts upon roads.

Georgia

Convicts guilty of misdemeanors may be sentenced to work in the chain-gang of the county. All felony convicts except such as are required by law to be kept at the State farm may be employed in the several counties. On or before February 10 annually, the prison commission shall communicate with the county authorities and ascertain those counties desiring to use convict labor. Convicts shall be apportioned according to population.

Idaho

The highway commission is authorized to make requisition upon the warden of the State penitentiary for convicts for road labor, subject to such rules and regulations as the board of prison commissioners shall prescribe. The warden and prison commission shall assign such prisoners as they deem physically able and at the same time reasonably safe to work on the State roads under the general direction of the highway commission.

Illinois

Convicts are not worked outside of prison except in rock quarries in getting out rock for the use of the State. Crushed rock and other road material created by convict labor shall be furnished free at the penitentiary where prepared to the State highway commission, provided such material shall be placed only upon a permanent public highway.

Indiana

The managing boards of the State reformatory and State prison may wherever there is no work for the inmates within the prison, arrange with the county commissioners or township trustees for working the convicts on the roads.

Iowa

State convicts may be worked at stone quarries, and the crushed stone produced, furnished to counties, townships, or road districts, f.o.b. cars at crushing plant.

Kansas

It is the duty of the warden of the penitentiary to employ the surplus convict labor in extending and repairing the state and county roads. By special act, the State will furnish the necessary labor from the penitentiary to build a macadam road from Leavenworth to Kansas City, provided the counties furnish right-of-way and material.

Kentucky

All male persons confined in county jails or work houses, under judgment of a court directing that they may be worked at hard labor, shall be available for work on county roads, upon the application of the road supervisor or overseer. In counties having work houses the superintendent thereof, the board of county commissioners and the road supervisor or overseer shall agree as to the terms of the employment on the roads, and in counties not having work houses, the county judge shall assign such prisoners as he shall think proper for work on the roads, upon application of the supervisor or overseer. The road supervisor or overseer shall be responsible for the safe-keeping of the prisoners assigned for work under him.

Note.—Constitutional amendment affecting convict labor now pending.

Louisiana

The State highway engineer, with the approval of the board of State engineers may use convicts for highway work, such convicts to be under the supervision and guardianship of the board of control of the State penitentiary.

Maine

Upon written application from county or municipal authorities the board of inspectors may direct that jail prisoners be worked on county roads.

Maryland

For the purpose of building and constructing or maintaining any road, bridges or highways under the provisions of this act (State highway act of 1910) or for the purpose of working any stone quarry operated by the State highway commission, the said commission is authorized to make request of the directors of the Maryland

House of Correction for as many inmates thereof as may be necessary for said purpose, and the said directors are directed to furnish same with a sufficient number of guards for their safe-keeping of the prisoners while so employed.

Massachusetts

Convicts may be employed in the preparation of road material by hand labor only, and are not employed in the construction and maintenance of highways.

Michigan

County road officials may direct the employment of county prisoners confined for petty offenses, upon the highways of the county.

The wardens of the State penitentiaries may, upon proper application from highway officials, put State prisoners to work in the same manner as county prisoners. State convicts may also be used in surface quarries and stone yards in preparing material to be used on the public highways.

Minnesota

No legislation providing for convict labor upon highways. They may be used for crushing stone for highway purposes on the prison grounds.

Mississippi

There is no general convict labor law in reference to highways. Most convicts are employed upon state farms. The superintendent of the penitentiary is authorized to improve and maintain roads from each convict farm in the State for a distance of 5 miles out from said farms.

In four counties, convicts between the ages of eighteen and and fifty sentenced to the farms may be required to work fifteen days on the roads.

Missouri

The warden and inspectors of the penitentiary may, in their discretion enter into contracts for the employment of not to exceed 300 convicts of the state penitentiary upon public roads and highways of the State at such times and places and upon such terms as the warden and inspectors deem proper.

Montana

County commissioners may require prisoners to labor "on the public works or ways in the county."

Under the State highway commission, act of 1913, county commissioners may have work done by prison or convict labor on State roads in their county.

Nebraska

For the purpose of enabling the county commissioners to employ in a profitable manner all convicts sentenced to hard labor, the board has authority to make rules and regulations and designate the place where the convicts shall work. The county jail is declared to extend to any quarry, road or other place the commissioners may designate.

Nevada

The State prison commissioners are authorized to detail for work on the public highways any male convict in the State prison who may be properly detailed, except prisoners under sentence of death, provided, that such detail shall be voluntary on the part of the convict.

Convicts so detailed are not required to wear stripes, are given ten days off sentence for each month's faithful work, and are paid 10 cents per day.

New Jersey

The board of chosen freeholders of any county may order the sheriff to cause all able bodied male convicts or so many as may be required, to be put to work on the public roads of the county.

The State commissioner of public roads, or the board of chosen freeholders of any county may make application to the prison labor commission for convicts to work on public highways. The prison labor commission in conjunction with the governing body of the penal institution determine the number to be assigned the cost of maintenance and compensation and may enter into an agreement for the payment of costs or any portion thereof.

The prison labor commission is authorized to acquire so much land for agricultural and quarry purposes as may be selected by said commission, and transfer prisoners for agricultural purposes, and to be employed in the quarrying and preparation of building and road materials.

New Mexico

Aside from the special acts of the legislature which provides for building certain roads by convict labor, a general act of 1909 provides that the State highway commission shall employ such convict labor as shall be available and advisable. The board of penitentiary commissioners shall on demand of highway commission furnish available convicts and also necessary guards, provided that the cost of transportation, maintenance and guarding while engaged in road work shall be paid from the road fund.

New York

The town superintendent with the consent of the town board may request the supervisor of the town under the provisions of section 93 of the county law to procure the services of the prisoners serving in the county jail for general work on the public highways of the town.

North Carolina

In counties having arrangements for working convicts upon public roads, the presiding judge shall sentence the following convicts to such work; all those convicted of crimes, the punishment of which is imprisonment in the county jail; those convicted of crimes, the punishment of which is confinement in the State penitentiary not exceeding ten years; those sentenced to imprisonment in a county jail by a magistrate.

North Dakota

The board of control is authorized to employ convicts upon the public highways, under the supervision of proper guards, all the convicts not needed in the State twine mills, and it is otherwise deemed practicable to so employ them. They may also be employed by the several counties of the State for work on the public roads thereof when it is mutually so agreed by the county commissioners and the State board of control, the county paying all the salaries and expenses in connection with said work. The convicts shall at all times be under State control, and shall be supervised by skilled laborers who shall at the same time act as guards. As nearly as practicable, all the men shall be pledged on their word of honor not to attempt escape, they shall be dressed uniformly, and shall bear some insignia not too conspicuous, and shall not be required to work more than ten hours in any one day. Also, a convict shall not be assigned to work in the community from which he came.

The convicts are entitled to a credit of from 10 to 25 cents per day, the exact amount depending upon the amount and manner of work done, and in addition thereto, those assigned to outside work are entitled to a double allowance of "good time."

Ohio

The governor shall have power to direct and require the Ohio board of administration, the warden, and such other officers who have charge of the keeping and maintenance of the prisoners in the Ohio penitentiary and Mansfield reformatory to furnish to the State highway department such number of able bodied prisoners as the State highway commissioner may certify to the governor can be advantageously employed upon any part or parts of the main market road system. The housing, guarding and maintenance shall be paid from the funds appropriated for such penitentiary or reformatory. Strict account shall be kept of all such labor to determine its actual cost to State.

Oklahoma

The county commissioners shall have authority by providing suitable arrangements therefor, to work all convicts confined in the county jail upon the public highways, and may by arrangements with the city council, work the prisoners of any city, but shall not pay therefor other than the cost of maintenance.

The State board of prison control may provide for the working of convicts upon the public roads of the State. The work shall be done upon roads designated by the county commissioners of the several counties. State convicts shall be divided into groups not exceeding 100 each. Only one group shall work in any county, and for a period not to exceed five months. No county shall receive the second group until all counties making application shall have received their proportion of the work from state convicts.

Oregon

State.—The State highway commission may authorize and provide for the construction of any State road or part of such road by convict labor; and if said commission so authorizes and provides convict labor, the governor shall, upon its request detail from the penitentiary such convicts as in his judgement may seem proper for use in the work of constructing said road or part of a road; and such convicts shall be delivered to said engineer on such terms and conditions as shall be prescribed by the parole board and approved by the governor.

County.—Upon the written request of the county court of any county, the governor may detail from the State penitentiary such convicts as in his judgment may seem proper for use on the public highways. Said convicts shall be delivered to any county court on such terms and conditions as shall be prescribed by the parole board and approved by the governor.

Pennsylvania

All male persons sentenced to county jails and workhouses may be assigned to work on the public roads of the county by the prison board. Preference shall be given to the making of new roads and the repair of main roads, all roads to conform to the plans and specifications of the State highway commission. The work shall be done in 5 mile sections by townships in rotation.

Rhode Island

No convict labor.

South Carolina

All able bodied male convicts are placed on the county chain-gang except those, who in the discretion of the presiding judge, should be placed in the State penitentiary. The county chain-gangs are engaged exclusively on the county roads. No State prisoners are worked upon the public highways.

South Dakota

When in the opinion of the sheriff any convict sentenced to hard labor can be more profitably employed outside of the jail or yard, it shall be his duty to employ said convict either in work on public streets or highways or otherwise.

Tennessee

County convicts may be worked upon the public highways of the county, subject to the direction of the county court.

Texas

The commissioners court may require all male county convicts, not otherwise employed, to labor upon the public highways under such regulations as may be deemed most expedient. Each convict worked on the roads in satisfaction of any fine and cost shall receive a credit thereon of 50 cents for each day he may labor and reasonable commutation of time may be granted as a reward for faithful service and good behavior, provided same shall not exceed one-tenth of the whole time.

Utah

Convict labor may be utilized in providing road material and also actual construction. Prisoners in the county jail may be required to work on the county roads under regulations made by the board of county commissioners, and prisoners in the state prison may be required to work on the State roads.

When state prison convicts are used in the construction or improvement of any State road, the work shall be under the authority and control of the State road commission, the state board of correction and the warden of the Utah State prison.

The State board of pardons is required to make provision for granting privileges and reduction of sentence for good behavior on part of convicts employed on roads.

Vermont

The sheriffs of the several counties may employ or cause to be employed able-bodied prisoners confined in county jails, upon conviction for crime, in the improvement of the public highways within a radius of 30 miles from such jail and outside of a city or incorporated village. The county sheriff makes necessary rules for the proper care of such prisoners subject to the approval of the attorney-general and governor. The State highway commissioner shall designate subject to the approval of the sheriff the highways upon which labor shall be employed. The highway commissioner or his assistants shall direct the work.

Virginia

After May 1, 1913, all male prisoners confined in the State penitentiary shall be subject to work on the State convict road force, except those considered unsafe by the superintendent. The road force shall be under the direction of a civil engineer appointed by the State highway commissioner, or of a guard so appointed who shall be well versed in road building. When local road authorities desire to make permanent improvement by contract, the State may furnish such force of convicts that at $1 per day will amount to 40 per cent of the contract price.

Washington

Whenever there are persons confined in the State penitentiary who are physically able to perform manual labor upon the public highways and who shall not be engaged in other work required by the State board of control, the same may be employed upon the construction and improvement of the public highways within the State.

The board of control shall monthly certify to the State highway commissioner the number of persons in the institution named who may be used for the work authorized under this act, and the state highway commissioner shall, whenever possible use such persons in the building or repair of public roads.

All work shall be under direction and supervision of the State highway commissioner, but the control and management of the convicts shall be under the supervision of the State board of control. All expense of care, maintenance and transportation above 25 cents per day for each convict shall be paid from the funds authorized to be used on the road being improved. Twenty-five cents per day shall be paid from the fund appropriated for the maintenance of the penitentiary.

County commissioners may order jail prisoners to work on the public roads under direction of the sheriff at a distance of not to exceed 5 miles from place of detention.

West Virginia

County courts may sentence convicts to be confined at hard labor in the county jail, and may designate what work as roads, bridges, etc.

Proceeds from leasing or hiring inmates of the penitentiary, less $20,000, shall be paid into the State road fund. In the State road bureau act of 1913, it is provided that county courts may apply to the State board of control for State prisoners to work upon the State highways of the county. The application will be granted if prisoners are available, provided, the state board of control may, for good cause, refuse to grant any application.

Wisconsin

Convicts in county jails may be used in breaking stone for road purposes.

Wyoming

Any convict may be put to work on the highways and streets. A recent law (1913) provides for a system of public highways consisting of twelve trunk lines to be improved by prison labor in accordance with plans of the State engineer.

DIGEST OF AUTOMOBILE REGISTRATION LAWS

Alabama. The law provides for annual registration of motor vehicles with the secretary of State. The schedule of fees is as follows: Less than 20 h.p., $7.50; 20 to 30 h.p., $12.50; 30 to 40 h.p., $17.50; 40 h.p. and over, $20; electric machines, $12.50; steam automobiles, $15; motor cycles, $3; manufacturers and dealers, $100; motor vehicles for hire, $25; chauffeur's license, $5.

The automobile revenues are not applied to roads. Forty per cent of the gross revenue derived from owners residing in incorporated cities and towns is returned to such cities and towns, and 40 per cent derived from owners in counties not residing in cities or towns is returned to the county of their residence. (Act, April 22, 1911.)

Arizona. The law provides for annual registration with the secretary of State. The registration fees are as follows: 25 h.p. and less, $5; 25 to 40 h.p., $1 ; over 40 h.p., $15; motor cycles, $2; dealers, one machine in each class, at regular rates; chauffeur's license, $5.

The revenues are credited to the State road tax fund. (Chapter No. 68, Laws 1913.)

Arkansas. The law requires annual registration with the commissioner of State lands, highways and improvements, payment to be made to the county tax collector, whose receipt is forwarded with the application for registration. The fees are as follows: All motor vehicles, $10; dealers, one machine in each class, at regular rate; chauffeur's license, $1.

The revenues are equally divided between the State and the county in which the revenue is collected, the State portion to be credited to the State highway improvement fund. The fees and forfeitures are paid into the general school fund of the county in which they are imposed. (Act No. 134, Laws 1911, as amended by Act No. 302, Laws 1913.)

California. Annual registration is required, the application to be forwarded to the State treasurer with fee and thence transmitted to the State department of engineering, which issues the necessary seals, etc. and makes necessary record. Registration fees are as follows: Less than 20 h.p., $5; thence to 60 h.p. and above, an increase of $5 for every 10 h.p.; motor cycles, $2; dealers, for each five cars operated, $50, and $10 for each additional car; motor cycle dealers, $5; transferring registration from one vehicle to another, $2; chauffeur's license, $2.

Not to exceed $5000 of the revenue may be expended by the State treasurer's office in connection with registration and not to exceed $10,000 by the State department of engineering in connection with registration. Half of the net revenues shall be returned to the county in which collected and credited to the road fund, and the remaining half remains in the State treasury for maintenance of State roads under the direction of the highway department of the State department of engineering. (Act of May 31, 1913.)

Colorado. Annual registration with the secretary of State is required. The fees are as follows: 20 h.p. and less, $2.50; 21 h.p. and 40 h.p., $5; 41 h.p. and over, $10; motor cycles, $2; chauffeur's license, $1.

Revenues are divided equally between the State and the county from which the revenue is received. The State's portion is credited to the State road fund, to be expended in improving and maintaining State roads, and the counties' portion is credited to the road fund of such county. Fines and forfeitures are divided equally between the State and the county and credited in the same way as the registration fees. (Act No. 49, Laws 1913.)

Connecticut. Annual registration with the secretary of State is required. The registration fees are as follows: Automobiles, 50 cents per h.p. with a minimum charge of $5; automobiles, livery, $10; motor cylces, $2; commercial motor vehicles, for first one thousand pounds capactiy, $7; and for each additional one thousand pounds, $3; dealers in motor vehicles, $50; dealers in motor cylces, $10; manufacturers minimum charge, $25; operators license, $2.

The revenues are placed to the credit of the State highway fund to be expended in the maintenance of State highways. (Acts of May 28, and June 4, 1913.)

Delaware. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Motor cycles, $3; all other motor vehicles, $5; operators, including owners, $5; manufacturers and dealers, for each car demonstrated on the roads, $5.

Registration revenues are credited to the general fund of the State treasury. (Act of April 29, 1909, as amended by Act of March 19, 1913.)

District of Columbia. Regulations provide for registration with automobile board. Schedule of fees is as follows: All motor vehicles, perpetual registration, $2; operator's, including owners, perpetual, $2; dealers license for each machine demonstrated, $2; (Regulations of July 18, 1913.)

Florida. The law provides for annual registration with the tax collector of the county in which the motor vehicle owners reside. The schedule of fees is as follows: Less than 10 h.p., $3;

11 to 29 h.p., $5; 30 to 40 h.p., $10; 41 to 50 h.p., $15; 51 to 60 h.p., $25; 61 to 70 h.p., $35; 71 h.p. and over, $50. Registration fees of vehicles used for hire are double the above rates.

Registration revenues are paid into the county treasury and credited to the county road and bridge fund. (Chapter No. 6212, Laws 1911.)

Georgia. The law provides for annual registration with the secretary of State. Registration fee for all motor vehicles is $5. The net revenue from registration is paid into the State treasury and credited to the State road fund. The said fund is apportioned to the several counties in the State in proportion to the number of miles of rural mail route in such counties. (Act No. 478, Laws 1910, as amended by Act of August 19, 1913.)

Idaho. The law provides for annual registration with the secretary of the State highway commission. The schedule of fees is as follows: 30 h.p. or less, $15; 31 to 40 h.p, $20; 41 to 50 h.p., $25; 51 h.p. and over, $40.00; motor cycles, $5.00; dealers and manufacturers, $35.

Registration revenues are paid into the State treasury and credited to the State highway fund for expenditure under the direction of the State highway commission. However, 70 per cent of the fees collected from the residents of any county which has issued road bonds shall be returned to such county for the payment of interest on the bonds. Fines and forfeitures are paid into the State treasury and credited to the same fund as registration revenues. (Chapter No. 179, Laws 1913.)

Illinois. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 25 h.p. or less, $4; 26 to 35 h.p., $6; 36 to 50 h.p., $8; over 50h.p., $10; all electric motor vehicles, $5; motor cycles, $2; manufacturers and dealers, $15; chauffeur's license, original, $5.

Registration revenues are paid into the State treasury and credited to the State road fund for expenditure only in the construction of permanent roads. Fines and forfeitures are paid into the treasury of the road district, town or city in which collected and credited to the road fund. (Chapter No. 121, Code of 1912,.as amended by Act of June 28, 1913.)

Indiana. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 25 h.p. or less, $5; 26 to 40 h.p., $8; 41 to 50 h.p., $15; over 50 h.p., $20; electric pleasure vehicles, $3; all commercial vehicles, $5; motor cycles, $2; manufacturers and dealers, $25; chauffeur's license, $2.

The net registration revenue is paid into the State treasury and credited to "a road fund" which shall be apportioned to the several counties on January 1 and July 1, of each year. Fines and forfeitures are paid into the State treasury and credited to the same fund as the registration revenues. (Chapter No. 300, Laws 1913.)

Iowa. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 20 h.p. or less, $8; each additional h.p. over 20 h.p., $.40 additional; all electric and steam vehicles, $15; motor cycles, $3; manufacturers and dealers, $15.

Eight per cent of the gross revenue is set aside in the State treasury as a maintenance fund for the State highway department. Eighty-five per cent of the gross revenue is apportioned to the several counties of the State for expenditure only for crowning, draining, dragging, graveling or macadamizing public roads outside of incorporated towns or cities. (Chapter No. 72, Laws 1911, as amended by Chapter No. 130, Laws 1913.)

Kansas. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: All motor vehicles, $5; motor cycles, $2; dealers shall register one in each class at regular rates.

The net revenue is paid into the county treasury of the county in which collected for expenditure only in maintenance of public roads. (Act of March 12, 1913.)

Kentucky. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Less than 25 h.p., $5; 26 to 49 h.p., $10; 50 h.p. and over, $20; manufacturers and dealers, one vehicle in each class, at regular rates.

Registration revenues are paid into the State treasury for the benefit of the State road fund. (Act of March 14, 1910.)

Louisiana. No State registration laws.

Maine. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 20 h.p. or less, $5; 21 to 35 h.p., $10; over 35 h.p., $15; motor trucks and commercial automobiles, $10; traction engines, $10; motor cycles, $3; operators, including owners, $2.

Registration revenue is paid into the State treasury and credited to a fund for the repair, maintenance and construction of State highways. (Chapter No. 162, Laws 1911.)

Maryland. The law provides for annual registration with the commissioner of motor vehicles at Baltimore. The registration fees are as follows: 10 h.p. or less, $5; 11 to 20 h.p., $10; 21 to 30 h.p., $15; 31 to 40 h.p., $20; and over 40 h.p., $25.00; all commercial motor vehicles, $3; motor vehicles, $1.80; dealers and manufacturers (motor cycles only, $10), $24; operators, including owners, (motor cycles, $1) $2.

One-fifth of the net registration revenue is apportioned to the city of Baltimore for use on its roads and streets and the remainder shall be expended for oiling, repair and maintenance of the modern State and county roads. Fines and forfeitures are paid into the State treasury for the same use as the registration revenues. (Chapter No. 207, Laws 1910, as amended by Chapter No. 68, Laws 1912.)

Massachusetts. The law provides for annual registration with the State highway commission. The registration fees are as follows: Less than 20 h.p., $5; 20 to 29 h.p., $10; 30 to 39 h.p., $15; 40 to 49 h.p., $20; 50 h.p. and over $25; motor cycles, $2; all commercial automobiles and trucks, $5; dealers and manufacturers, $25; and $5 for each additional car over five demonstrated on the roads; dealers and manufacturers motor cycles only, $10; operators, including owners, $2.

The net registration revenue shall be expended under the direction of the State highway commission for maintenance of State highways, provided that an amount not exceeding twenty per cent of such reveune may be expended by the Commission for the repair, improvement and construction of local roads used as through routes. All fines and forfeitures are credited to the same fund as registration receipts. (Chapter No. 534, Laws, 1909, as amended to January 1, 1914.)

Michigan. The law provides for registration with the secretary of State, annually. The schedule of fees is as follows: All motor vehicles per h.p., $.50; dealers and manufacturers, not to exceed five vehicles used on the road, $50, and $10 for each additional vehicle so used; dealers and manufacturers motor cycles only, $20.

The registration revenue, after deducting five per cent for expenses, shall be paid into the State treasury for expenditure under the direction of the State highway department in addition to the regular appropriation. (Act No. 318, Laws 1909, as amended by Act No. 181, Laws 1913.)

Minnesota. The law provided for triennial registration with the secretary of State. Registration fees are as follows: All motor vehicles, $1.50; dealers and manufacturers, one machine in each class, $10; chauffeur's license, $3.

The registration revenue is not applied to roads, but is paid to the State treasury to the credit of the general fund. (Chapter No. 365, Laws 1911.)

Mississippi. Chapter No. 108, Laws 1912 provided for State registration of motor vehicles, but the act was declared unconstitutional by the State Supreme Court, May, 1913.

Missouri. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Less than 12 h.p., $2; 12 to 23 h.p., $3; 24 to 35 h.p., $5; 36 to 47 h.p., $7; 48 to 59 h.p., $8; 60 to 71 h.p., $10; 72 h.p. and over, $12; dealers and manufacturers, $16; chauffeur's license, $1.50.

The registration revenue is paid into the State treasury to the credit of the State good roads fund, but specific appropriation by the legislature is necessary before expenditures are made. (Act of March 9, 1911, as amended by Act of January 31, 1913.)

Montana. The law provides for registration with the secretary of State. Schedule of fees is as follows: All motor vehicles, perpetual, $2; chauffeur's license, perpetual, $2.

The net registration revenue is paid into the State treasury and credited to the State highway fund, to be expended in constructing State roads and for apportionment to the several counties of the State. (Chap. No. 73, Laws 1913.)

Nebraska. The law provides for annual registration with the secretary of State, payment of fees to be made to the treasurer of the county in which the vehicle owner resides. The schedule of fees is as follows: Motor cycles, $1; all other motor vehicles, $2; manufacturers and dealers, one of each class of vehicles, at regular rates. The registration revenue is credited to the road fund of the county in which it is collected. (Chapter 115, Laws 1911.)

Nevada. The law provides for annual registration with the secretary of State. The registration fee is 12½ cents per h.p., minimum fee, $2.50. Motor cycles exempt.

The net registration revenue, when it aggregates $25,000, shall be apportioned to the several counties of the State for construction of county roads under the joint supervision of the county commissioners and the State engineer. (Chapter No. 206, Laws 1913.)

New Hampshire. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Motor cycles, $3. Automobiles, 15 h.p. and less, $10; 16 to 30 h.p., $15; 31 to 40 h.p., $20; 41 to 50 h.p., $25; 51 to 60 h.p., $30; 61 h.p. and over,.$40. Motor trucks, 1 ton capacity or less, $10; over one and less than two tons capacity, $12.50; over two and less than five tons capactiy, $15.00; over five tons capactiy, $20. Automobiles used for carrying passengers for hire, $10; manufacturers and dealers, $25.

The net registration revenue shall be expended in the maintenance of highways in accordance with the State highway laws, provided that 35 per cent of such net revenue may be expended in the maintenance of roads in cities, towns and places where roads are not ordinarily maintained with assistance of the State. Fines and forfeitures are paid into the State treasury for use in the same manner as registration revenues. (Chapter No. 133, Laws 1911, as amended by Chapter No. 81, Laws 1913.)

New Jersey. The law provides for annual registration with the assistant secretary of State, who is exofficio commissioner of motor vehicles. The schedule of fees is as follows: 10 h.p. and less, $4.50; 11 to 29 h.p., $7.50; 30 h.p. and above, $15; motor cycles, $2; motor trucks weighing over 4,000 pounds, in addition to regular fees, $10; dealers and manufacturers for each car demonstrated, $5; operators, including owners, for cars not exceeding 30 h.p., $2; operators, including owners, for cars exceeding 30 h.p., $4; motor vehicle line carrying passengers operating from and adjoining State $100.

The net revenue derived from registrations, fines and penalties shall be deposited in the State treasury for use in repairing the more important improved roads of the State, under the direction of the commissioner of public roads. (Chapter No. 113, Laws 1906 as amended to January 1, 1914.)

New Mexico. The law provides for the annual registration with the secretary of State. The schedule of fees is as follows: Less than 12 h.p., $2; 12 to 19 h.p., $4; 20 to 29 h.p., $6; 30 to 39 h.p., $8; 40 to 49 h.p., $10; 50 h.p. and over, $12; dealers and manufacturers, $12.

The net registration revenue shall be paid into the State treasury and credited to the State highway fund for expenditure upon the public highways of the State, preference being given to automobile routes. (Chapter No. 19, Laws 1913.)

New York. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 25 h.p. or less, $5; 26 to 34 h.p., $10; 35 to 49 h.p., $15; 50 h.p. and above, $25; all motor vehicles used for commercial purposes only, $5; dealers and manufacturers, $15; chauffeur's license, $5; motor cycles exempt.

The revenue derived from registrations, fines and forfeitures is paid into the State treasury for appropriation to be used for maintenance and repair of improved roads of the State under the direction of the State highway commission. (Chapter No. 374, Laws 1910, as amended in 1911.)

North Carolina. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 25 h.p. or less, $5; 26 to 40 h.p., $7.50; 41 h.p. and over, $10; motor cycles, $2; manufacturers and dealers, $10.

The registration revenue shall be paid into the State treasury and a separate account kept of it. On July 1, of each year, 80 per cent of such revenue shall be returned to the county from which collected for expenditure upon the public roads of such county and for no other purpose. (Chapter No. 107, Laws 1913.)

North Dakota. The law provides for annual registration with the secretary of State. The registration fee for all motor vehicles is $3.

The net registration revenue is returned to the county from which collected for expenditure for repairs and maintenance of the main traveled roads of the county, provided that no part of said funds shall be expended within the limits of an incorporated town or city, nor within any township that does not levy a road tax of at least 6 mills on the dollar of assessed valuation. (Chapter No. 6, Laws, 1911.)

Ohio. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Motor cycles, $2.00; electric motor vehicles, $3.00; gasoline and steam motor vehicles, $5.00; dealers and manufacturers, motor cycles, for each make manufactured or dealt in, $10.00; dealers and manufacturers, other vehicles, for each make manufactured or dealt in, $20.00; chauffeur's license, motor cycles, $1.00; chauffeur's license, all other motor vehicles, $3.00.

The net revenue derived from motor vehicle registrations shall be paid into the State treasury and one-third of the same shall be used for the repair, maintenance, protection, policing and patrolling of public roads and highways. The remaining two-thirds of the net revenue goes into the general fund of the State. (Chap. 21, Code 1910, as amended to March 1, 1914.)

Oklahoma. The law provides for annual registration with the State highway department. The registration fee for automobiles is $1.

The registration revenue shall be used to create a fund for the maintenance of the State highway department. (Chapter No. 105, Laws 1911.)

Oregon. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 26 h.p. and less, $3; 27 to 36 h.p., $5; 37 to 40 h.p., $7.50; over 40 h.p., $10; electric pleasure vehicles, $3; electric commercial vehicles, $5; motor cycles, $3; chauffeur's license, $2; manufacturers and dealers, $10.

The net balance of registration revenues on December 31 of each year is returned to the county treasurer of the county from which collected to be credited to the general road fund. Fines and forfeitures are also paid to the county treasury to be credited to the general road fund. (Chapter No. 174, Laws 1911, as amended by Laws of 1913.)

Pennsylvania. The law provides for annual registration with the State highway department. The schedule of fees is as follows: Less than 20 h.p., $5; 20 to 34 h.p. $10; 35 to 49 h.p., $15; 50 h.p. and over, $20; motor cycles, $3. Motor vehicles with solid tires, less than 4,000 pounds gross, $5; 4,000 pounds and less than 5,000 pounds gross, $10; 5000 pounds and less than 10,000 pounds gross, $15; 10,000 pounds and less than 15,000 pounds gross, $20; 15,000 pounds and not over 24,000 pounds gross, $25; not licensed over 24,000 pounds. Chauffeur's license, $2; dealers and manufacturers for each pair of number tags, $10.

Registration revenue is paid into the State treasury to be available for expenditure in assisting in the construction, maintenance, improvement and repair of State highways and State aid highways. Fines and forfeitures imposed for violation of the provisions as to speed and weight shall be paid into the treasury of the city, borough, town or townships in which such violations occur for expenditure in construction, maintenance and repair of the highways thereof. Other fines and forfeitures are paid into the State treasury for use in the same manner as registration revenues. (Act No. 385, Laws 1913.)

Rhode Island. The law provides for annual registration with the State board of public roads. The schedule of fees is as follows: 20 h.p. or less, $5; 21 to 30 h.p., $10; 31 to 40 h.p., $15; 41 h.p. and over, $25; all commercial vehicles, $2; motor cycles, $1; dealers and manufacturers, $50; operators, including owners, $1.

The revenue derived from registrations, fines and forfeitures is paid into the State treasury to be used for the repair and maintenance of State roads under the direction of the State board of public roads. (Chapter No. 86, Laws 1908, as amended to January 1, 1914.)

South Carolina. The law provides for registration with the clerk of court of the county in which the owner resides. Registration fee for all motor vehicles is $1.

The law makes no provision for the distribution of the revenue from registrations. (Act No. 55, Laws 1906.)

South Dakota. The law provides for annual registration with the secretary of State. The application for registration shall be filed with the county treasurer and the payment of fees made to him. The schedule of registration fees is as follows: Automobiles, $6; motor cycles, $2.

Twelve and one-half per cent of the gross revenue is transmitted to the secretary of State with the application to be expended in payment of costs in connection with registration. Eighty-seven and one-half per cent of the gross revenue shall be retained by such county treasurer for expenditure only in grading, crowning, draining, dragging, graveling or macadamizing public highways of the county under the direction of the board of county commissioners. (Chapter No. 276, Laws 1913.)

Tennessee. The law provides for registration with the secretary of State. The registration fee (perpetual) is $2. The State registration certificate shall be recorded with the clerk of the county in which the vehicle owner resides, for which a fee of $1 may be charged. The law makes no provision for the disposition of the registration revenues. (Chapter No. 173, Laws 1905.)

Texas. The law makes provision for registration with the Clerk of the County in which any motor vehicle owner resides. The registration fee (perpetual) is 50 cents.

The revenue from registrations apparently goes to the clerk making the registration. (Chapter No. 96, Laws 1907.)

Utah. The law provides for registration with the secretary of State. The registration fees (perpetual) are as follows: All motor vehicles, $2; chauffeur's license, $2.

The registration revenues are paid into the State treasury and there credited to the State road fund to be expended under the direction of the State highway department. (Chapter No. 113, Laws 1909.)

Vermont. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: First registration, per h.p., $1; second registration, per h.p., 75 cents; third and subsequent registrations, per h.p., 50 cents; operators, including owners, $2.00; manufacturers and dealers, $25.

The net registration revenue is paid into the State treasury to be expended for the repair and maintenance of main thoroughfares and State roads under the direction of the State highway commissioner. (Chapter No. 176, Public Statutes of 1906, as amended to January 1, 1914.)

Virginia. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: 20 h.p. and less, $5; 21 to 44 h.p., $10; 45 h.p. and over, $20; motor cycles, $2; manufacturers and dealers, $50; chauffeur's license, $2.50.

The net registration revenue is paid into the State treasury to be credited to a special fund for expenditure in permanent improvements of the main highways of the State, under the direction of the State highway commissioner and in accordance with the State aid highway act of 1908. (Act of March 17, 1910.)

Washington. The law provides for annual registration with the secretary of State. The registration fee is $2.

The law makes no special provision for the disposition of the registration revenue. (Chapter No. 154, Laws 1905.)

West Virginia. The law provides for annual registration with the State auditor. The fee for motor vehicle registration is $10. Chauffeur's license (perpetual) $2. The registration revenue is not applied to roads but goes into the general fund of the State. (Chapter No. 32, Code of 1906, as amended to January 1, 1914.)

Wisconsin. The law provides for annual registration with the secretary of State. The schedule of fees is as follows: Motor cycles $2; all other motor vehicles $5; dealers and manufacturers, for each garage, $5.

Three-fourths of the net registration revenue is returned to the county from which collected at the end of each year, same to be expended in repairing highways outside of incorporated towns and cities. The remaining amount of such revenue shall be credited to the State highway fund in the State treasury. (Chapter No. 600, Laws 1911.)

Wyoming. The law provides for annual registration of automobile with the secretary of State. The registration fee is $5.

Four dollars of each registration fee paid is returned to the county treasurer of the county from which received, and shall be credited to a special fund for expenditure only for temporary improvement of the county roads. The remaining one dollar of such registration fee is retained by the secretary of State for the payment of expenses incident to such registration. (Chapter No. 95, Laws 1913.)

TYPES OF ROADS

Earth Roads

The importance of earth roads is indicated by the fact that of the approximate mileage of 2,200,000 in the United States, 2,000,000 are classed as earth roads. The work in the future upon earth roads should contemplate (1) proper drainage, (2) reduction of grades, (3) improvement of alignment, (4) betterment of the road surface.

Proper Drainage.—The prevailing defect in earth roads is poor drainage and this defect is the first one which should be remedied. Drainage is for two purposes, first to remove water which reaches the surface of the road by precipitation or otherwise and, second, to remove under ground water which reaches the road from adjacent land or through the top surface. Surface drainage is accomplished by securing a reasonably firm crowned traveled roadway and by providing broad shallow ditches of good alignment and uniform grades and with ample outlets. Subdrainage to remove water from beneath the road surface or to prevent its presence in the roadbed is accomplished most effectively by socalled blind drainage or French drains or special sub-side-drains. There are also other methods. These methods include center subdrains or V-shaped drains or sometimes rock bottoming in the form of a rough telford construction. The best side-drains consist of a trench 3½ feet deep, 15 inches wide at the top, in which is laid an open bell joint glazed tile 4 to 6 inches in diameter with the bells up hill and the trench back filled with broken stone or coarse gravel. The main purpose of these drains is to intercept ground water. The joints of the pipes should be left open and the drains should lead into a proper outlet so that the water may go entirely away from the road. One such drain upon the up-hill side of a road will frequently remedy the worst conditions due to the presence of water. The V-drain consists of a shallow V-shaped trench under the entire traveled way which is back filled with field stones or cobbles. Such construction requires considerable excavation but is somewhat cheaper than two side-drains. The excavation must be 12 to 18 inches deep at the center and 6 to 8 inches deep at the edges. It should be back filled with stones ranging from 6 to 10 inches in diameter with the largest in the bottom. To dispose of water collected by this drain, trenches should be dug about every 50 feet and back filled with stone. These trenches should lead entirely away from the road so it is seen that this construction is mainly available for either roads located over fills on boggy land or on side-hills when the outlets will of course be on the down hill side only. Subdrainage should not be undertaken without proper lines and grades furnished by an engineer as it is expensive and if properly put in would constitute sufficient drainage for any subsequent improvement of the road by macadamizing or otherwise.

Returning to the matter of surface drainage, the earth road should be kept free from ruts by the use of the road drag or otherwise and a crown of 1 inch to the foot should be preserved. Water is thus shed toward the sides. The side ditches collect surface water and must be kept free. On heavy grades they will tend to wash and may require paving in the worst cases. The wash may usually be prevented by providing sufficient outlets to reduce the volume of water. A common defect in earth roads is failure to provide side-drains to discharge water away from the roads Surface drainage is greatly hampered and interfered with by drive-ways leading into private grounds. Raised drive-ways across open gutters divert the water into the center of the road and unfortunately in most instances where tiled drains have been placed, they have become broken or clogged and every considerable rain storm threatens the destruction of a portion of the roadway. The only point where such a drive-way is safe is at the top of a grade. Even when drive-ways are provided with under drains it is common to find that the drainage of the drive-way itself runs into the road. Surface drainage then upon earth roads demands fearless treatment of the drive-way problem. It would probably pay in most instances to pave the bottom of the gutter where the drive-way crosses it and leave the side drainage free.

When it becomes necessary that drainage water cross the road, ample culverts must be provided. The worst fault common to culverts is that they rapidly become clogged with leaves or other rubbish. They should therefore be of more than sufficient size in the first instance. When less than from 2 to 3 feet of earth cover tile pipe, it is liable to become broken. The prevalent defect on earth road construction in the matter of culverts is that they are too small and too near the surface. It will pay even in earth road construction to install more expensive culverts in the first instance rather than to rip them up for repairs at frequent intervals.

Grade and Alignment.—The worst grade on any road is the effective limitation of traffic. After a grade exceeds a rise of 6 feet in the hundred it is serious. Grades may be avoided or reduced either by relocation in part or by excavation and embankment. The best treatment of earth roads in the matter of grades is to establish once and for all a definite, permanent grade with the engineer's level. It need not follow that the entire road is to be graded but with the grade line in mind the worst hills may be cut down and the worst hollows filled up and year by year the entire road will progress toward a final and satisfactory profile. Much money has been wasted by not adopting such a grade line at the outset. In the matter of relocation it is, of course, impossible for a road well established in the community to be entirely changed or abolished in most cases. Grade improvement may have to be brought about by relocating smaller portions of earth roads. Here, again, the services of a surveyor or experienced road supervisor with a transit will prove economical in the end. Some necessary relocation may be undertaken each year. In reducing grades or relocating for earth roads, it is not necessary that all cuts and fills should balance as excess of material may always be used to widen fills and a deficiency of material can usually be supplied by widening the cuts. In the matter of roads over rocks or ledges, it is cheaper to fill up hollows with borrowed earth than to undertake excessive rock cutting. In constructing or repairing an earth road, it is quite common to use the scraping grader or road machine. Where work with this machine is undertaken the width of the road between gutters should be determined. It is a common fault to to find earth roads too wide. Twenty-four feet between gutter lines is ample for a road which a community is not warranted in improving by macadamizing or otherwise hardening its surface. Frequently 20 or 18 feet is a sufficient width. With the width between gutters in mind, a line of stakes should be set before the grader begins its work. The line of stakes along each gutter will improve the work of the grader and leave gutters which will not tend to cause wash into the road.

Surface Betterment.—When it is desired to spread new material upon an earth road care should be taken to secure it from the best available supply. It is not good practice to place gravel in patches upon an earth road to fill hollows. Materials should be spread uniformly upon the traveled way and should be applied for a considerable distance and the ends of the application should be reduced in depth gradually so as not to form a new chuck hole. The object of the scraping grader is to simultaneously construct gutters or side-drains and place material for a crown in the center.

Right here is opportunity for a great improvement in earth road work. Sod, leaves, vegetable matter and rotted material of any description can never form a road surface. There are two ways of using the grader. It may be operated at first to cut the surface only and scrape all perishable material into ridges which are later carted away or the grader may be run regardless of sod and other poor material and men with rakes and forks can then follow it and remove all objectionable matter into dump wagons. Old roads are frequently in such condition that it is better to scrape the shoulders and gutters away from the center and remove the entire mass. Frequently this operation alone will result in a well established and crowned roadway with live material for its surface.

Conclusion.—The earth road problem today is a problem of repair and maintenance. No earth road will endure travel without constant care. The use of the split-log drag which is described in the paragraph upon maintenance is the best method for preserving road surfaces and establishing proper surface drainage from the traveled way to the side ditches. Earth road repairs will become unnecessary in proportion to the increased care in road maintenance. It cannot, however, be expected to start any maintenance upon an earth road until it is put in reasonable repair. The repair should follow the lines indicated above, that is to say, earth road repair should include some permanent drainage work, the reduction of some of the worst grades, the straightening of bad curves and the betterment of the road surface by the removal of worn out and objectionable material.

Sand-Clay Roads

A sand-clay road is composed of sand and clay mixed in such proportions as to form a compact and firm support to traffic. The perfect sand-clay road should be neither sticky nor sandy. The sand and clay may form a natural mixture, in which case the road is termed a "natural sand-clay road." The two materials may have become mixed in the fields along the road by successive cultivation of soil, and this soil known as "top soil" is sometimes used in road construction.

There are many varieties of both sand and clay, consequently there is a wide variation in the characteristics of a sand-clay road. Sand while one of the hardest minerals known, possesses practically no binding or cementing power. The grains of sand instead of cohering in a tough mass under the impact of traffic and the action of water, remain loose and shifting. No road is so difficult to travel as the road located through fine sand, and the difficulties are enormously increased when high winds prevail.

Clay is a decomposition product of the mineral feldspar. If the clay has been carried by water the deposit is known as "sedimentary clay." If the feldspathic rock has disintegrated in place, the product is known as "residual clay." The sedimentary clays are in general more sticky and plastic than the residual clays. In contrast with sand, which possesses no binding power but is very hard, clay is a powerful binder, but does not possess the quality of hardness. It is evident that in the construction of a sand-clay road the sand must furnish the quality of hardness amd resistance to wear while the clay must furnish the quality of toughness and bind the individual sand grains firmly together.

The theory of the sand-clay road is very similar to the theory of the macadam road. In the latter, rock dust and screenings fill the voids between the angular fragments of stone and when wet serve as a cement or binder. The grains of sand may be likened to the angular fragments of stone and clay to the rock dust binder. In the most successful sand-clay road, just a sufficient amount of clay is used to fill the voids between the grains of sand. In this way, the sand sustains the wear, while the clay serves as a binder. If too much sand is used, the result will be loose sand on the surface; if too much clay is used, the surface of the road will become sticky after rains.

The best mixture of sand and clay can be made when the materials are wet, and particularly is this true of the "ball clays." The more water that is used, the better the mixture, and if practicable, the materials should be puddled. A disk harrow may be used to advantage.

The extent to which the mixing can be carried on will depend largely upon the character of the clay. If it is a very plastic clay, much greater effort will be necessary to obtain a complete mixture; if, on the other hand, it is a slaking clay, the mixing will be much less difficult. Slaking clays are not as satisfactory, however, as the ball clay, as their binding powers are much less. In selecting clay for road purposes, it is always best to select the stickiest clay available. A common test is to wet the thumb and place it against a piece of clay. If the clay sticks to the thumb, it is reasonable to suppose that it will stick to the sand; if it will not stick to the thumb, it is safe to assume that it will be a poor binder in a sand-clay road.

If the clay is placed on sand to a depth of 6 inches, a cubic yard of clay will cover 54 square feet, consequently a 16-foot road treated in this manner would require about 1 cubic yard of clay for each 3 feet of length. A mile of 16-foot road would, therefore, require 1760 cubic yards of clay. The amount that can be hauled by the average team varies from two-thirds to 1 cubic yard, according to the character of the road over which the hauling is done.

If the clay sub-soil is to be treated with sand, it should be plowed and harrowed to a depth of about 4 inches. On this prepared sub-surface should be placed from 6 to 8 inches of clean sand, spread thickest at the center and sloping to the sides in much the same manner as the clay is applied to a sand road. These materials should then be mixed dry instead of the wet mixing, which is preferable when clay is applied to sand. This is preferable, because the clay can be better pulverized when in a dry state. After the dry mixing, the road should be heavily sprinkled or should be puddled after the first heavy rain. After the materials are thoroughly mixed and puddled, a road machine or grader should be used to give proper crown to the road, and if a roller is available the road can be improved by the use of it. As it is impossible to determine exactly the proportions of sand and clay to be used in the first place, it is necessary to give careful attention to the sand-clay road for a considerable time after it is completed, in order that additional sand or clay may be applied as needed.

Gravel Roads

There are three important qualities which should be possessed by road-building gravel—hardness, toughness, and cementing or binding power. Of these three qualities, the last is the most important. This binding quality is due in part to the presence of oxide of iron, lime, or clay, and in part to the angular shape and size of the pebbles composing the gravel. Blue gravel is generally conceded to be the best for road construction, because it is usually derived from trap rock. As the pebbles composing the gravel retain the characteristics which they formerly possessed as a part of the larger rock itself, it follows that as trap rock is considered an excellent material for road building, trap rock gravel should occupy the same relative rank among the gravels. Quartz possesses practically no binding power, although it is very hard. Therefore, gravel which contains an exceptionally large percentage of quartz will not prove successful, as it will fail to consolidate unless it contains binding material, or unless a good binder is added. This, however, is not true of the chert gravels which bind and consolidate very well forming excellent roads.

The shape and size of the pebbles composing the gravel have an important bearing upon its value as a road material. In order that the material may bond readily, the pebbles should be angular and should vary in size so that the smaller fragments may fill the voids between the larger pieces. Gravel obtained from streams is usually inferior to pit gravel for the reason that the action of the water has worn the pebbles smooth and practically all the fine binding material has been removed by the same agency. Even if clay or loam is mixed with river or creek gravel, the result is not likely to be as satisfactory as that obtained by the use of pit gravel. Pit gravel frequently contains too much clay or earthy matter, while river gravel may have too much sand. In such cases it is advisable to screen the gravel so as to eliminate the material which is too fine and that which is too coarse. The screen should be similar to that which is used in preparing material for a macadam road. In the handling of the gravel care should be exercised not to separate the binding material from it, nor should this binding material be allowed to settle to the bottom in spreading the material over the road surface. It will often be found advisable to spread a thin layer of such binding material over the surface after the material has been distributed and rolled, and after this the surface should be sprinkled and rolled again, or else rolled while still damp from the rains.

When the gravel, especially that which is to constitute the surface layer, contains large pebbles, these should be removed and either thrown aside or else raked into the foundation or recrushed. At least 60 per cent by weight of the gravel should be pebbles above one-eighth inch in size, and there should be no pebbles in the bottom layer that will not pass through a 2½-inch or 3-inch ring, and in the top layer there should be no pebbles which will not pass through a 1½-inch ring. Not over 20 per cent of the mass should be clay, and this should be uniformly mixed and should contain no large lumps. Ten or 15 per cent of clay produces better results than 20 per cent. If the foundation or road bed is loose, it should be carefully rolled. It is quite as important to have a solid foundation for a gravel road as for a macadam road. Gravel will compact to about 80 per cent of its depth, loose measure. If the compacted depth of the gravel road is to be 8 inches and the width 12 feet, it will take about 2250 cubic yards of gravel to the mile, and it is best to make the first layer about 6-inches in depth, loose measure, and the second layer about 4-inches in depth, loose measure.

Gravel should not be dumped directly on the road, as this will usually result in a rough, uneven surface. A carefully staked out sub-grade or "box" with earth shoulders is necessary. The sub-grade should be rolled. If specially devised spreading wagons are not used, the gravel should be dumped on boards and spread from them on to the road. The gravel should be placed on the road commencing at the end nearest the gravel pit in order that the teams may aid in packing the material.

Each layer of gravel should be rolled separately with a power roller; the rolling should begin at the sides and continue toward the center until the surface is thoroughly compacted. The surface layer should be sprinkled while the rolling is in progress, but if a roller and sprinkler are not available, the road should be constructed during the wet season of the year, as the rains will cause the material to pack much better than if the road were built during the dry season.

The split-log drag, or some similar device, can be used to advantage in maintaining gravel roads but it will be necessary to use hand rakes to remove excessively large stones which appear on the surface. New gravel must be uniformly spread from time to time.

Macadam Roads

The macadam road takes its name from John L. Macadam, whose biography appears in this volume. The word *macadam* denotes a surfacing composed of angular broken stone bound together, whose voids are filled with stone screenings flushed with water, and which is consolidated by rolling, into a practically impervious crust, superposed on a thoroughly compacted foundation or subgrade. Both the exposed surface and the subgrade have a crown or slope from center to sides.

A good macadam road should have (1) proper location, (2) easy grades, (3) perfect drainage, (4) firm subgrade or foundation, (5) broken stone with good wearing and bonding properties and (6) careful inspection during the construction. Proper location and easy grades are more essential for macadam roads than for less expensive types of roads for the reason that unless right at the outset they cannot be changed without extraordinary expense.

Perfect Drainage.—Drainage must remove water from the road surface and the foundation and carry it entirely away from the road. The properly completed macadam surface sheds water into broad open side ditches by virtue of the road crown. The side ditches may have to be paved upon steep grades especially where they carry considerable water from adjacent land. When ditch water must cross the road, catch basins are usually necessary and ample culverts should be provided of first class construction (see article on culverts). To drain the road foundation or subsoil, side-drains with tiled pipe and stone back fill are most effective. Where considerable field stone is present a shallow so-called V-drain forming the entire subgrade is cheaper than two side-drains and equally effective in providing sub-drainage. The V-drain filled with stone not greater than from 8 to 10 inches in diameter with the larger stones at the bottom, should be brought to the true crown and rolled and it should have frequent outlets entirely away from the road. When properly built, the V-drain offers an excellent foundation for the macadam surface. In particularly damp or boggy spots a telford foundation or bottoming course of hand laid stone not less than 6 inches in depth is sometimes used. Modern practice, however, seems to favor either the sub-side-drain or the V-drain construction for drainage purposes. Sub-drainage is usually required in heavy cuts on hillside roads and for roads over swampy land.

Subgrade.—After a road has been properly graded and the permanent drainage structures completed, the subgrade must be built. In cuts through firm soil, the subgrade is formed by simply excavating a trench of width and depth equal to the width and depth of the compacted stone surfacing. Spongy material wherever encountered must be removed and replaced by good live earth or gravel. Where loose dry sand is encountered, the utmost care is necessary to prevent the sand from churning into the first layer of broken stone when rolling commences. In fills if the earth has been deposited in layers and subjected to teaming, the subgrade trench or box may be excavated and afterwards thoroughly rolled. Care must be taken to insure that the subgrade is thoroughly solid and it must not wave under the roller. Material excavated from the subgrade is piled along the sides or shoulders to form earth abutments to prevent spreading of the macadam when it is rolled. Too much care and refinement cannot be given to the subgrade or foundation for the macadam. It should invariably be rolled to a true firm surface, clean and without ruts and with perfect crown. There will then be no waste of stone or churning of earth into the lower course to weaken the macadam and the tendency of the finished road to form holes will be largely avoided.

Broken Stone.—Trap rock is the best road stone for plain macadam or "waterbound" macadam construction. It is frequently desirable, however, to use local stone and the Office of Public Roads, U. S. Department of Agriculture, will test stone samples from any locality in this country free of charge. This Office has published complete tables showing the relative merits of nearly all road stones. Road stone should (1) be hard enough to wear well, (2) so tough that the roller does not crush it, (3) and possess bonding qualities to form a smooth unyielding surface. Road stone is usually placed in two courses; the first course ordinarily consists of stones varying in size from 3 to 1½ inches in greatest diameter. The softer stones may be somewhat larger than the denser or tougher material. Ordinarily a roller cannot compact more than 6 inches of loose stone successfully and it is customary for the first course to be rolled separately. The stone is spread either from spreader wagons or from dumping boards. Careless dumping of the stone directly upon the subgrade in piles will result in an uneven finished surface. The first course is sometimes called the no. 1 stone. It is thoroughly rolled with a steam roller until walking does not loosen the stones. Teams hauling stone over the subgrade should guard against cutting ruts or churning the stone in the subgrade soil. Upon the rolled first course, a second course of stone varying in size from 1½ to ¾ inches in diameter is placed to a depth of about 3 to 5 inches in a manner similar to the first course. When the second course stone has been rolled until its surface is smooth and the individual stones are well keyed together and no creeping or wavering appear before the front wheel of the roller, the bonding process commences.

Careful Inspection.—Bonding of a macadam road is accomplished by completely filling the voids in the broken stone with fines or screenings from the crusher. The best practice requires that these screenings be from the same stone as is used in the top course. The process of binding or bonding requires the greatest care. The fines or screenings or stone dust should be worked in the road *gradually*. To accomplish this, the screenings are spread in thin successive courses with alternate wetting by a sprinkling wagon and continuous rolling. Care should be taken that wagons drawing screenings should not cut up the partially built road. When the voids are completely filled mud will flush to the surface in front of the roller and the bonding is complete. If the macadam is well bonded, the road is now strong enough to withstand the kick of a boot-heel.

The width and depth of macadamized surfaces are governed by local conditions. A one-way road may be as narrow as 8 feet. The general practice is to build macadam surface from 14 to 16 feet in width. The thickness of the macadam surface is determined somewhat by the traffic conditions and varies from 5 to 8 inches when complete. Loose broken stone is usually estimated to consolidate about one-third under rolling.

A newly built or green macadam road will sometimes immediately show tendency to ravel particularly if the second course stone is trap rock. This raveling usually cures itself but if it continued, removal of the larger loose stones and additional rolling may be necessary.

Bituminous Macadam Roads

The term "bituminous macadam"[47] was introduced about the year 1906 to designate a macadam road, for which some form of bituminous material was used as a binding agent and to form a surface coat. The desirability of changing from the original type of what is now called "waterbound macadam" was brought about unquestionably by the action of increasing automobile traffic. When the presence of automobiles of various types and speeds became general on macadam roads, it was found (1) that more or less dust was raised from the surface by the passing automobile and that this dust usually was carried away from the road; (2) that the surface of the dry macadam road soon raveled and in the worst conditions completely disintegrated; (3) that it was too expensive to water macadam roads sufficiently to prevent the formation of dust and the consequent destructive effect of excessive automobile traffic.

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[47] In justice to those who claim that the term "Bituminous Macadam" should be used in a much more restricted sense the following definition from the Report of the Sub-Committee on Bituminous Paving Nomenclature of the American Society of Municipal Improvements is given.

(3) Bituminous macadam is a pavement consisting principally of crushed stone and retains its integrity of structure mainly by the mutual support of the various particles of stone, aided by the slight bonding value of the fine mineral matter in its composition, and which is protected from surface disturbances by an upper bonding layer of bituminous material. It is a one-layer pavement and there is no definite distinction to be made between the wearing surface and the base, as in their nature they must be knit together in one structure. Practically all the horizontal stability, as well as vertical

A bituminous macadam road does not differ from the original macadam construction until the process of binding begins. It has been found, however, that the former desirable qualities in road stones, such as hardness, toughness, and cementing qualities, do not play so important a rôle as formerly when the stone in question is to be treated with bituminous material. If we assume then the construction of a macadam road to have progressed through the stages of proper drainage, grading and consolidation of the subgrade, we then place the first course of No. 1 stone upon the rolled subgrade, as formerly. This no. 1 stone is still laid in the same standard sizes ranging from 2½ to 1¼ inches in diameter. After this course has been thoroughly rolled to consolidated thickness, say from 3 to 5 inches, the no. 2 course is than applied. There are two well defined methods for applying this course.

Mixing Method.—No. 2 stone varying in diameter from 1¼ to ½ inch is cleaned and dried. It is then mixed with sufficient quantity of bituminous material to thoroughly coat all the pieces. This may be done by hand labor upon a mixing board, or by raking stones through a bath of the bituminous liquid, or otherwise. The practice of using mixing machines similar to concrete mixers is increasing and with the better types of machines results are satisfactory and the cost is reduced. Practice has shown that it requires in the neighborhood of 1½ gallons of bituminous material per square yard of finished surface, so that if a second course were spread 3 inches thick loose, a cubic yard of stone would require about 18 gallons of bituminous material. After the coated stone has been put in place, a thin layer of clean, sharp fines (from which the best practice demands the removal of the dust) is spread lightly and the course is then rolled with a steam roller. Wherever an excess of bitumen appears on the surface, more fines should be added and

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support, is from the macadam base. The pavement may be produced by adding the bituminous top to the macadam base by either the penetration method or the mixing method. In the former the bitumen is applied in a liquid state and a top dressing of stone or sand is spread over the surface and thoroughly rolled. In the latter the bitumen is mixed with the mineral, consisting of comparatively fine stone or sand, or a mixture of both, and forced into the macadam body of the pavement by rolling. In either case, whether the penetration or mixing method is followed, the macadam base must be specially prepared, with voids in the upper portion into which the bitumen or bituminous mixture penetrates leaving a coating of the desired thickness over the surface.

rolled. After rolling is completed, all surplus fines and dust should be swept from the surface. A seal coat or paint coat or finishing coat of bituminous material to insure waterproofing and complete filling of the voids is now applied. This consists of a uniform application of about one-half gallon to the square yard of surface. Screenings or fines are again applied and the road may or may not be rolled.

Penetration Method.—By the penetration method, the second or no. 2 course of stone is put in place and partly rolled with a steam roller. The bituminous material is then applied either by hand from pouring pots or by some modified hose nozzle leading from a tank cart or by a mechanical distributor. Material for hand spreading is usually brought to the job in barrels; when a tank cart is used, it is generally filled from a tank car at the siding. Bituminous material is heated usually by steam from a steam roller, but when hand pots are used, the material is heated with kettles over fires. The application is about 1½ gallons to the square yard and the object is to penetrate the second course to a considerable depth. It is now considered good practice to apply the bituminous material under pressure from a hose fitted with a proper nozzle to spread the material in a finely subdivided stream, or spray. The object is to secure better penetration and more uniform distribution over the road stones. After the distribution of bituminous material, a light coating of sharp, clean fines or screenings or sometimes sand or clean gravel is applied and rolling progresses. A paint coat of about one-half gallon to the square yard is usually applied, followed by a coat of screenings to complete the construction.

The above description presents a bold outline of bituminous construction and it must be understood that various modifications in processes are practiced, e.g., the no. 1 course may be bound with screenings or no. 2 course may also be partly bound with screenings, even with the use of a sprinkler and subsequent drying of the road. Some engineers prefer to apply the stone without screening into separate sizes with the object of securing the reduction of the voids by the use of crusher run stone. Other engineers have seen fit to use no. 1 stone as the second course. The practice of spreading the broken stone in sizes and then thoroughly mixing by harrow or otherwise, is not uncommon. It is clearly evident that the final standardization of bituminous construction has not yet been reached. In round figures, the cost of bituminous macadam runs about 25 to 40 cents per square yard in excess of ordinary "waterbound" macadam.

Some engineers contend that an ordinary plain macadam construction, followed by a thorough paint coat, is the most desirable form, but this is essentially surface treatment.

A system introduced in England by Arthur Gladwell, now known as the Gladwell system of bituminous road construction, requires the spreading of a mixture of sand and bituminous material or fines and bituminous material over the top of the no. 1 or first course of macadam followed by a no. 2 course of clean, dry stone and a second layer of mixed fines and bituminous material. The three layers are then rolled with a steam roller. The object of this form of construction is to secure a thorough filling of the second course of stone by the mixture of fines and bituminous material from both above and below.

Throughout this description the term "bituminous material" has been used as a generic term and should be read to include all forms of artificial binders which are in common use.

The details of the management of bituminous material are extremely important. It is known that a proper selection of the bituminous binder is vital to the success of construction. Standard specifications for bituminous material are not yet in complete agreement. There are certain chemical tests which it is known that good bituminous material should satisfy. It is quite possible that these chemical tests have not yet developed final form and that additional physical tests should be introduced to enable proper selection of material. For further details as to matter of pressure, temperature, viscosity, etc., the reader is referred to articles upon bituminous road materials.

Brick Roads

Vitrified paving brick have been in use in this country a little more than thirty-five years as a wearing surface for streets and highways. In their early history little attention was given to using them in the most advantageous way, either as to durability or as to the possible satisfaction in their use. It was rather a commingling of varied ideas with a good material, with no definite realization of what is really possible in a brick street constructed under the most approved methods of today.

Vitrified paving brick are manufactured from the less refractory fire clays and shales which are found in almost all of the bituminous bearing deposits throughout the United States. No two deposits of these shales or clays are exactly alike; they do not burn alike either in color or in the amount of heat required to bring them into the best condition adaptable for their use, so that the raw material must receive slightly different treatment at each of the factories. On this account brick of different manufacture differ in appearance.

A brick burned sufficiently to develop the best quality from any one of the clays and shales used is almost impervious; at least sufficiently so that the amount of moisture absorbed, regardless of temperature, does not affect the brick in any way. The adhesion of the particles is brought about by sufficient heat to bring them into a molten state. The process has brought into a new use the word "vitrified" and in connection with the manufacture of paving brick that word is given a new meaning. It does not mean that perfect vitrification is obtained as in the manufacture of glass, but an approach to it, forming a coalescent body.

In the use of vitrified brick for a wearing surface, due consideration must be given to the amount and character of the traffic in determining the width of the road and the character of construction. The amount of money possible to expend must also have due weight. The available local ingredients which may be used in the construction of the road in addition to the brick, must also be taken carefully into consideration. For example, it is necessary to determine whether concrete shall be used as foundation, and, if so, of what the concrete shall consist, or whether there shall be any artificial foundation at all. The question of whether the road is to to be located in the northern portion of the country subject to extreme climatic conditions or in the extreme south where low temperature need not be guarded against is of great importance. The question of drainage also enters materially into the problem.

The type of the road therefore must be influenced by some one or more or even all of the foregoing, as every feature to a greater or less extent bears a particular relation to the economy of the road itself. To illustrate: the black mucky soil of somewhat difficult drainage of northern Illinois where practically all of the thoroughfares are subject to a traffic of numerous and heavily loaded vehicles, and subject also to extremes of low temperature and liable to consequent damage from frost, require the best and more expensive type of roads. In and about the Gulf Coast where the soil for the most part carries a large proportion of sand and is not subject to frost action economical roads can be built without any artificial foundation at all by merely preparing the grade to correspond with that of the finished highway. The requirements for these two types of roads as to local conditions to a very large degree equalises the cost in respective localities. For instance, in northern Illinois the brick on account of freight rates are slightly less in cost and the material, such as gravel and broken stone, which enter into the foundation are of low cost so that a road built in northern Illinois corresponds in price to the road equally adapted to conditions found in the South and this state of affairs very largely obtains throughout the country, so that the cost of adaptable types is not materially different.

As to the different types and kinds they may be approximated as follows: the best and most expensive type that shall meet severest conditions as well as severest traffic must be made with a carefully drained and thoroughly compacted subgrade, the surface of which shall be made to exactly conform with that of the finished highway. Upon this subgrade must be placed a concrete base finished with a smooth surface and from 4 to 6 inches in depth. On this base a compressed sand cushion to a uniform depth of two inches is placed. Upon this 2-inch sand cushion must be placed the brick with the best edge up. These bricks after being so placed must be rolled and ironed out so that the plane presented by the surface shall be entirely free from any depressions. Following this condition the interstices shall be completely filled with a mixture in uniform preparation of 1 to 1 of sand and portland cement. Provisions shall also be made along either curb for contraction and expansion. The details for installation of this work may be obtained from the National Paving Brick Manufacturers Association by a request for the same addressed to their headquarters in Cleveland, Ohio. The cheapest and least expensive type eliminates from the foregoing the foundation of concrete and even cement filler so that a road in the sandy districts can be made based upon the expenses of the brick, the curb and the preparation of the grade. Intermediate conditions necessarily obtain here and there throughout the country where with good judgment economy may be greatly subserved in the manner and method of building with due consideration of the traffic to which the roads respectively are to be subjected. Let it be thoroughly understood that the highest and best type is not only satisfactory and sanitary but of the greatest durability. However, the cheaper type is ofttimes advisable because of lower first cost and traffic requirements. The maintenance cost of a well constructed brick road is small and its advocates claim that this cost is negligible.

Concrete Roads

Types.—The methods of construction of concrete roads divide them into one course, two course and one and two course reinforced.

Materials.—1. Portland Cement. The cement shall meet the requirements of the United States government for Portland cement or of the standard specifications for Portland cement of the American Society for Testing Materials.

2. Fine Aggregate. Fine aggregate shall consist of sand, crushed stone or gravel screenings, graded from fine to coarse, and passing when dry a screen of ¼-inch mesh. It shall be preferably of silicious material, clean, free from soft particles and dust (both loose and occurring as a coating on the grains), loam, vegetable or other deleterious material; and not more than 3 per cent shall pass a sieve having 100 meshes per lineal inch. Fine aggregate shall be of such quality that mortar composed of one part Portland cement and three parts fine aggregate, by weight, when made into briquettes,

will show a tensile strength at least equal to the strength of 1:3 mortar of the same consistency, made with the same cement and Standard Ottawa Sand. In no case shall fine aggregate containing frost or lumps of frozen material be used.

3. Coarse Aggregate. Coarse aggregate shall consist of inert materials, such as stone or gravel, graded in size, retained on a screen of ¼-inch mesh, and passing a screen of 1¼ inches mesh. It shall be clean, hard, durable and free from all deleterious matter and shall contain no soft flat, or elongated particles. In no case shall coarse aggregate containing frost or lumps of frozen material be used.

4. Natural Mixed Aggregates. Natural mixed aggregates shall not be used as they come from deposits, but shall be screened and remixed to agree with the proportions specified.

5. Water. Water shall be clean, free from oil, acid, alkali, or vegetable matter.

Equipment.—In addition to the usual equipment needed in the preparation of the subgrade or foundation for all types or roadways, there will be required for the construction of a concrete roadway a good concrete mixer of the batch type provided with traction power, a sufficient amount of 2-inch lumber for side forms, wheelbarrows, shovels, the finishing and other small tools owned by every contractor doing concrete work and some means for hauling materials.

On large work, or long hauls or in districts where men and teams are scarce, hauling with traction engines has been found to be most economical, and the comparatively large amount of water required can probably be best attained from the nearest source of supply by pumping through small metal pipe lines with small gasoline engines, rather than by hauling in tank wagons with teams.

Foundation.—The subgrade or foundation upon which concrete is to be laid should be made flat and brought to a firm unyielding surface by rolling, and all soft, spongy or yielding spots and all vegetable or perishable matter should be entirely removed from the subgrade and the space refilled with gravel, broken stone or other suitable material. Special attention should be paid to drainage and water must be kept from reaching the foundation by means of open ditches or tile or French drains, provided with suitable outlets. Old macadam or gravel roadways make ideal foundation upon which to lay concrete, provided the same are scarified and made flat and the surface sealed with clay or loam or other material thoroughly wet and rolled, which will prevent the grout from the concrete running into the sub-base and will prevent any bond between the sub-base and the pavement. The surface of the sub-base must be smooth and free from all irregularities.

One-Course Roadway.—Upon the properly prepared subgrade concrete should be deposited having a thickness of at least 5 inches at the sides and 7 inches at the crown. It should be made in the proportion of at least one bag of Portland cement, 1½ cubic feet of fine aggregate and 3 cubic feet of coarse aggregate. The mixture should be laid in a sloppy wet condition and the surface struck off with a template cut to the proper shape of the road and running on the side forms. The rough places left after the use of the template, should be smoothed with a wooden float.

Two-Course Roadway.—Upon a properly prepared subgrade should be laid concrete mixed in the proportion of at least 1 sack of cement to not more than 2½ cubic feet of fine aggregate and not more than 5 cubic feet of coarse aggregate, having a thickness of at least 4 inches at the sides of the road and 6 inches at the crown. The concrete should be mixed as wet as is practicable, and should be placed as soon after mixing as possible but in no case should more than thirty minutes elapse between the mixing and the placing of the concrete base. The concrete base should be deposited in strips extending across the full width of the area paved and should be brought to a surface the thickness of the wearing surface below the finished surface of the roadway.

The concrete base before it begins to harden should be covered with a wearing course at least 2 inches thick composed of one sack of cement and not more than 2 cubic feet of suitable fine aggregate.

The wearing course should be placed as soon as it is mixed and in no case should more than forty-five minutes elapse between the mixing of the concrete base and the finishing of the wearing course.

After the wearing course has been struck off with a template the rough places should be smoothed with a wooden float.

Protection.—The concrete shall be sprinkled with water as soon after finished as may be possible without pitting the surface. It shall be kept moist in this manner for at least 7 days during which time it shall be protected from the elements by covering with canvas, sand or earth. No travel shall be allowed upon it until the concrete is 10 days old.

Joints.—To provide for free movement of the concrete, the road should be laid with joints of ¼-inch width not more than 30 feet apart. Such joints should be vertical and extend entirely through the concrete. They should be filled with tar paper or a waterproof filler.

Crown.—The road should be given a crown at the center of at least one-hundredth and not more than one-seventy-fifth the width of the road.

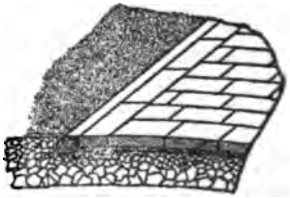
Reinforced Concrete Pavement.—When the road is 20 or more feet wide, reinforcing shall be used; the same shall consist of wire fabric or of plain or deformed steel bars. The cross-sectional area of the transverse reinforcing shall amount to at least 0.041 square inch per lineal foot of length of roadway measured parallel to the axis of the street. The cross-sectional area of the longitudinal reinforcing shall amount to at least 0.025 square inch per lineal foot of width of roadway measured perpendicular to the axis of the street. The reinforcing shall be placed 2 inches from the upper surface of the pavement, and shall be lapped, where necessary, sufficiently to develop the full strength of the metal. The reinforcement shall extend to within 1 inch of all joints in pavement and under no condition shall be continuous across them.

Asphalt Blocks on Country Roads

As designed and manufactured for use on country roads, the asphalt blocks are 5 inches wide, 12 inches long, and 2 inches deep, weigh about eleven pounds each, and have a specific gravity of about 2.40.

The asphalt block was developed and perfected on the theory that crushed trap rock, on account of its preëminent hardness and inherent grittiness, made the best known material for a roadway surface, the one thing needed being a cement, or binding material, to keep all of the particles permanently in place. This was accomplished by the use of an asphaltic cement to bind together the properly graded particles of crushed trap, the hot mixture being consolidated by tremendous pressure into blocks so dense and free from voids as to be practically non-absorbent. In the asphalt block, therefore, we have an asphaltic concrete, or macadam, mixed, in exact proportions, at a great central plant, under conditions insuring absolute uniformity, and receiving the compression necessary to produce a dense and non-absorbent material.

Not only has a special block been produced, but a special method of construction has been worked out, designed to utilize what is left of the worn and rutted macadam road as a foundation for the blocks. This is accomplished by scarifying the surface, if necessary, filling up the deep ruts, rolling with a heavy steam roller, and laying upon the surface of the old macadam, a bed of cement mortar about 1 inch in thickness, to serve the double purpose of forming a firm unyielding bed for the blocks, and binding them securely to the macadam foundation underneath. By this method the material used in the original construction of the road is not thrown away, but used as foundation for a permanent wearing surface. Where the old macadam is too thin, or too badly worn to be safely used as a foundation, it will be necessary to lay a concrete base, but usually there is broken stone enough in the old macadam to supply what is needed for laying concrete.



A pavement may be laid of any desired width, contour, grade, or crown. It is perfectly feasible to pave one-half of the roadway, or only a narrow strip in the center, and extend the paved area at a later date as traffic necessities require, or as appropriations become available. It is not necessary to set curbstones or heading stones to border or define the paved area, since a row of stretcher blocks held firmly in place by a shoulder of mortar, as shown in the sketch, answers the purpose perfectly and leaves the entire roadway surface smooth and uniform.

A good example of this construction is on the Albany Post Road, through the villages of Hastings-on-Hudson, North Tarrytown and the Town of Mount Pleasant, N. Y., and on the Boston Post Road in Pelham Manor and Rye, N. Y.

ROAD MAINTENANCE AND REPAIR

Repairs of all kinds of roads should take place before maintenance charges are begun. Too often the terms maintenance and repair are confused. If the maintenance of a road is neglected, it will be necessary eventually to repair it. A well maintained road, on the other hand, may never require repair.

The repair of earth and gravel roads usually involves reshaping and drainage and the subsequent betterment of the road surface. Special items of repair are replacing culverts, refilling washed portions of the road, excavating new ditches, etc. The repair of gravel and earth roads is well explained in the article on construction of the same.

To distinguish the repair of macadam roads from the maintenance of the same, the word repair may be restricted to those operations commonly called resurfacing. When an old macadam is worn so thin or becomes so full of chuck holes that its life is endangered, it is usually resurfaced; the period is about 6.5 years. It is becoming increasingly common to resurface macadam roads with some form of bituminous construction. If the old macadam surface is first scarified or picked up with the roller or hand labor, and considerable new stone added the repair operations go forward from this point as in bituminous macadam construction. When no bituminous material is used in macadam road repairs, the surface stone is brought to true crown and thoroughly rolled and bonded as in ordinary macadam road construction. There is considerable variation in the method and amount of scarifying or loosening of the old macadam surface; e.g., if a macadam road has simply developed a horse track or worn travelled way for a width of 6 to 8 feet in the center, the road is sometimes repaired by thoroughly sweeping and adding sufficient new stone to restore the crown without scarifying. Sometimes the edges only of a macadam roadway are scarified or picked to insure a bond of new stone with the old road course. Scarifying or picking up of the old road surface may be entirely omitted and new stone put in place without disturbing the road crust. This should never be done without first thoroughly scouring the old surface with stiff brooms and flushing with hose, if possible, otherwise a dust layer will be present and no bond develops between the new and old material. Of course, if a hose cannot be had, thorough dousing with a sprinkling cart will suffice.

Many macadam roads are now repaired by what is known as surface treatment. This is essentially a modified form of bituminous construction by the penetration method. A typical example of this process is as follows: The old road is thoroughly cleaned of all dust and refuse; and application of bituminous material is made on the road of ½ gallon to the square yard followed by a uniform coating of screenings or fines, preferably of screened trap rock. These screenings should not exceed ⅓ inch in greatest diameter. If ruts or holes are present, they may be brought up to a true surface with screenings. The road is now rolled; another application of ½ gallon to the square yard of bituminous material is made and the second course of screenings applied. Such depressions as developed are of course filled with screenings as the work proceeds and a sufficient excess of bituminous material should be given to such spots. A supply of surface screenings should be left along the road when such repair methods are used so that they may be spread subsequently to take up any excess of bituminous material that develops on the surface.

Maintenance

Undoubtedly the best system of maintenance for all roads is that which provides for the permanent and sometimes continuous employment of skilled laborers who have charge of particular sections of road, or who may be assigned to any part of the county or other road unit where there is work most needed. Men employed in this way become experts in their particular line and if they make mistakes one year or in one place, they are apt to correct them but, under the labor tax system, mistakes are often repeated. If one man is employed to look after a particular stretch of road, he will learn to take pride and interest in his work.

The continuous maintenance system has been adopted in this country only to a limited extent. It has been used by the Massachusetts highway commission for several years. The New York State highway commission introduced it in the year 1910 for the maintenance of State roads, and Allegheny County, Pennsylvania, employs it for the maintenance of about 100 miles of county roads. The office of Public Roads has also determined its effectiveness on experimental stretches.

While it would be manifestly impossible to adopt the continuous maintenance system throughout the country on account of limited resources, and sparse population, still there are many places where it might be used with success. It would be difficult to find a county which is so poor that it could not afford to employ continuously eight or ten laborers and three or four teams to maintain and repair its roads. That such a plan would be more effective than the labor tax system has been often proved.

Of all our roads, the earth roads are probably the most neglected. The first and last principle in the maintenance of earth roads is to keep the road well drained. Water is the great enemy to our clay or soil roads, and must be removed immediately, or mud results. To insure good drainage, the ditches must be free and the smooth crown of the road maintained. For this purpose the split-log drag, or an equivalent drag is very useful and, at the same time, inexpensive. The drag can be used on a sand-clay road or gravel road with good effect.

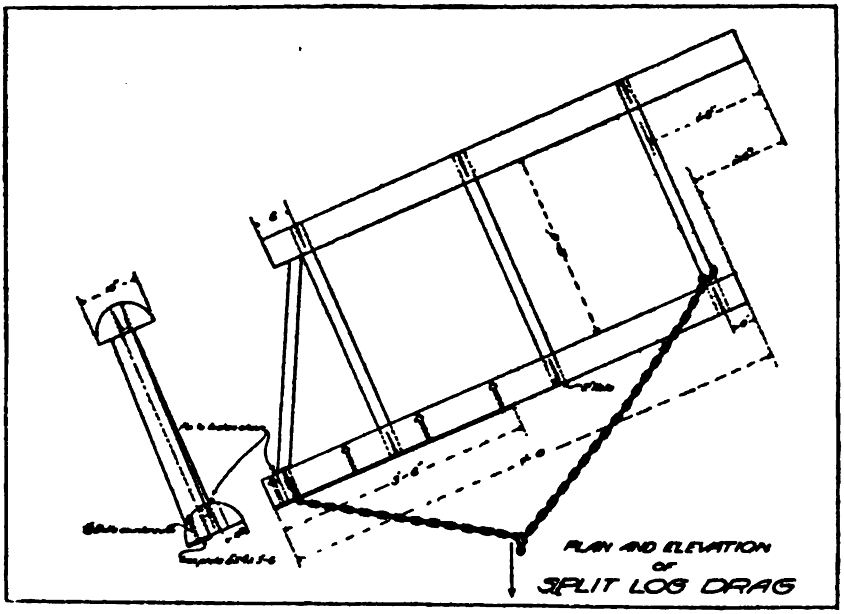
The following points govern dragging on earth, gravel or sand-clay roads: The drag should be light, and should be hauled over the road at an angle of about 45 degrees so that only a small amount of earth is pushed to the center of the road. The driver should ride on the drag and not drive faster than a walk. Some men like to weight the drag and direct it by handles arranged like plow handles. Dragging should begin on the side of the road, or wheel track and return on the opposite side. Unless a road is already in good condition, it should be dragged after every heavy rain, when the mud will puddle well, and still not adhere to the drag. A few trips over the road will give the operator a clue as to the proper and best time to drag. If a road is dragged immediately before a cold spell, it will freeze smooth.

Always drag a little earth toward the center to keep the slope of the crown about an inch to the foot. If the drag cuts too much, shorten the hitch or change your position on the drag. The results from dragging are obtained only by repeated applications. A good system of dragging is that which is practiced in Kansas and Iowa, where road authorities are authorized to let contracts to farmers for dragging the roads abutting their lands. The cost of dragging will be for from $.75 to $1.25 per mile per complete dragging of several trips. The cost will depend on the width and price of teams. From 15 to 30 draggings should be given a road the first year.

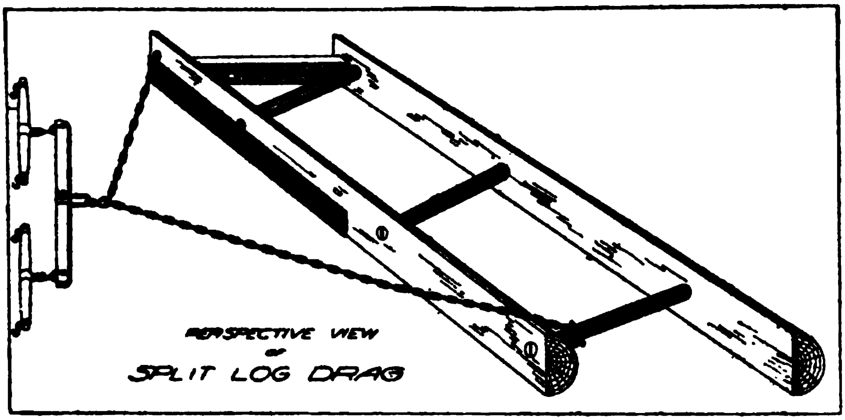
With reference to the maintenance of macadam roads, it is pertinent to state at the outset that it is doubtful practice now to patch macadam roads without using some form of artificial binder. A few automobiles a day passing a well made patch will frequently destroy it. There are, however, roads where a strictly macadam surface must be maintained. In repairing such roads, the stones should be applied only after the depressions have been thoroughly cleaned with stiff brooms and it is desirable to pick the edges with hand picks. The stones should be thoroughly rammed and bound with fines. An essential feature of all stone road repair is to have a supply of stone and binding material at frequent intervals, not less than 100 tons to the mile. Do not attempt to patch a road with stone greater than 1½ inches in longest dimensions and use clean screenings. Road sweepings or organic matter and rubbish must never be used to bond stone patches. The maintenance of all kinds of macadam roads will be more effective if such roads are rolled in the spring with a steam roller when the frost has left the ground.

Where a patrolman has charge of waterbound macadam roads, he should take advantage of all wet weather to discover depressions in the road and to improve drainage. A patrolman should also remove all loose stones as they are particularly injurious to automobile tires and to the road used by automobiles. Such stones should be collected in piles of sufficient size so that no stone is wasted. An important item of maintenance of macadam roads is the paring of the shoulders and attention to weeds and sod which encroach on the roadway. If a road has been lined and graded it should be possible to cut weeds and grass on the shoulders with a mowing machine.

The importance of all forms of maintenance on roads is becoming more clearly recognised. It is an administrative problem. Where good business management is introduced, success follows. It is quite possible that extensive modern roads can be absolutely maintained for an indefinite period if they are given the proper surface treatment at necessary intervals. Frequently, however, even the best constructed road depreciates and ultimately requires rebuilding, because of the failure to properly systematize the maintenance.



PLAN AND ELEVATION OF SPLIT LOG DRAG



PERSPECTIVE VIEW OF SPLIT LOG DRAG

DUST PREVENTIVES

Until comparatively recent years, the macadam road, if properly constructed of suitable material, was theoretically correct and practically sufficient to withstand the average traffic of our rural communities. It was dependent for its bond upon the dust produced by traffic, and so long as this dust remained upon the road surface to be washed into the interstices by occasional rains, a macadam road gave excellent and satisfactory service. With the advent of modern fast motor traffic, however, these roads began to deteriorate rapidly, since the rubber tire created practically no dust, but raised such as there was and allowed it to be carried away from the surface. This displacement not only robbed the road of valuable binding material, but created a menace to the health and comfort of the community. The need for a remedy soon became of paramount importance, and we have at present a great variety of materials for the purpose of laying the dust and thus tending to preserve the surface.

Water has been, of course, the best known and most generally employed dust preventive. It effects a mechanical bond between the particles of dust and rock, and with certain types of rock it has been shown to develop a chemical bond by hydrolyzing some of the rock components with the formation of colloidal cementing materials. The effect, however, is only temporary, and under heavy motor traffic, in dry weather, continual sprinkling is necessary which soon becomes an expensive item. Sea water has been tried with better success, owing to the fact that certain magnesium and calcium salts contained in it are capable of retaining moisture for a considerable length of time. The large amount of common salt also contained forms an objection to sea water, since in wet weather it leads to the formation of a salty mud which is injurious to the paint and iron work of vehicles. The good results of sea water without its disadvantages are obtained by the use of calcium chloride which is obtained as a comparatively cheap by-product in the manufacture of soda by the ammonia or Solvay process. This material was formerly applied in solution, but recently it has been prepared in a fine granular form to be spread over the road surface in a thin layer. It takes up water immediately, giving the surface a damp appearance, and proves quite efficient where the average moisture in the atmosphere is sufficient to feed the salt. Otherwise, an occasional light sprinkling with water is necessary. The salt is, of course, washed away by repeated rains and must be replenished from time to time, so that the cost of the treatment is largely dependent upon local climatic conditions.

The purpose of the above-mentioned materials has been essentially to retain water as a binding agent in the road surface. Another by-product which of itself contains some excellent binding qualities is commercially known as "Glutrin." It is a concentrated waste sulphite liquor obtained by the evaporation and treatment of liquors obtained in the manufacture of paper from wood pulp by the sulphite process. When diluted with water and applied to the surface of a macadam road, it effectively reduces the formation of dust, and produces a firm, hard surface. The binding material, however, is soluble in water, and the treatment must be repeated during a season.

The waste molasses or "black strap" from sugar refineries in conjunction with milk of lime has also been used in surface treatment, and this gives some promise of becoming an economic and satisfactory material in localities where it can be obtained cheaply. It depends for its binding value upon the formation of calcium sucrates by the action of lime on the sugar contained in the molasses. These are tough, sticky substances, sparingly soluble in water and possessing considerable binding value. The use of this material is at present, however, an experimental proposition.

The greatest development in the preparation of dust preventives has been made in the utilization of bituminous products such as petroleums, coal tars and water-gas tars. These materials were first used in their crude state, but the results were only partially satisfactory, so that now we have to deal almost entirely with refined products. Practically the only exceptions to this statement are the recently exploited Trinidad oils, which consist naturally of a light volatile fluid carrying a large amount of true asphaltic base, and some of the more fluid crude California petroleums which are all of an asphaltic nature. Artificial products in many ways resembling the Trinidad oils have been produced by fluxing and cutting back some of the oil asphalts with volatile distillates. Some nonasphaltic petroleum preparations are used with satisfactory results as dust preventives and in proportion to their viscous or adhesive quality, make the fine particles of dust adhere to each other, thereby holding the powdered top dressing in a moist cushion in the center of the road, consequently helping to preserve macadam roadbeds against pitting or raveling.

In order to facilitate the application of petroleum products, more particularly to park roads and suburban streets, emulsions have been prepared with some cheap soap as the emulsifying agent. When such an emulsion is properly compounded, the oil becomes readily miscible with water and can be successfully applied from an ordinary sprinkling cart. Many of the large producers now have on the market so-called emulsified oils which contain a proper amount of soap to permit of their being mixed with water quite readily.

Increasing quantities of tars which are obtained as by-products from our gas and coke industries, are being used for the manufacture of dust preventives and road binders. Low carbon coke oven tars and water-gas tars or mixtures of the two when properly refined are the most desirable of this type of product for cold surface applications; and a considerable amount of work is being done with light tars carrying a small percentage of an oil asphalt in solution.

The cold application of any of the types of petroleum or tar products may be made when the material is sufficiently fluid, but the more viscous products must be heated. In either case, best results are obtained by first cleaning and repairing the road surface, after which an application of sufficient material to uniformly cover the surface should be made. The quite common mistake of flooding the surface and permitting large quantities of material to go to waste in the ditches should be guarded against. When possible, traffic should be kept off the road for ten or twelve hours to allow the application to penetrate thoroughly, after which a light coat of sand or stone screenings may be spread over it. A treatment of this character not only keepsdown the dust for some time but, when a proper grade of material is used, forms a protecting mat which prevents excessive wear on the road surface.

A clean, practically dustless surface is the prime requisite for any form of successful surface treatment, and neglect to have such a properly prepared surface is too frequently responsible for unsatisfactory results. The surface should be reasonably clean for the application of a simple dust layer, since it is not the purpose of such an agent to lay any quantity of dust which may be present on the road, but rather to hold the products of wear for a period after the application has been made.

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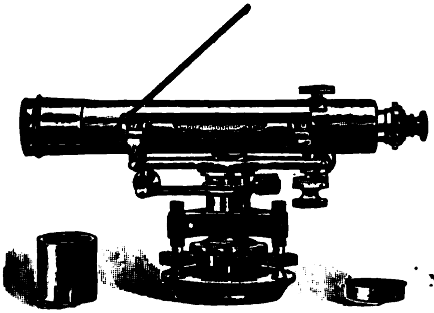

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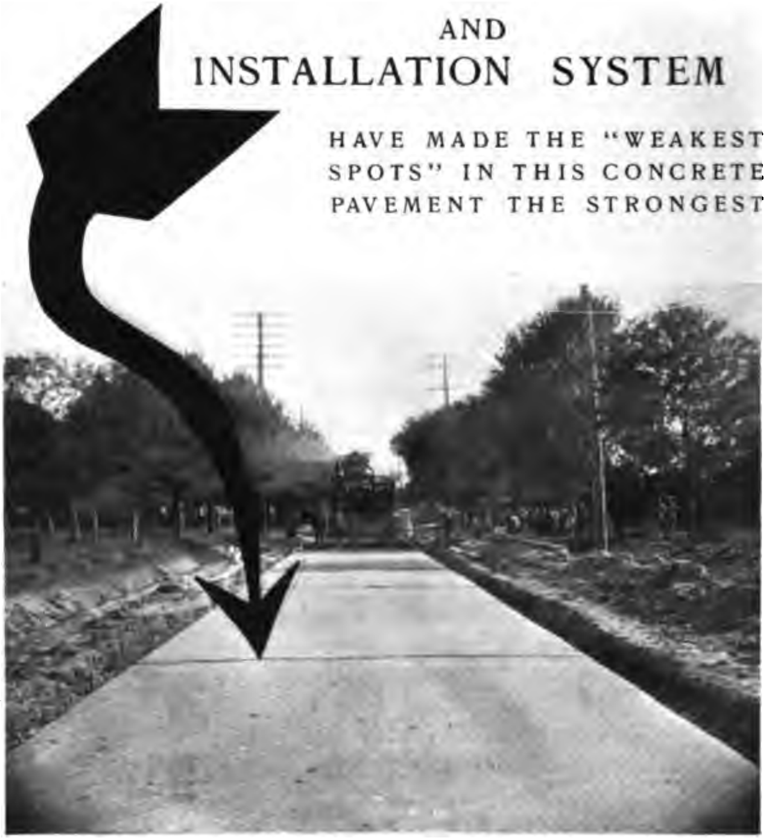

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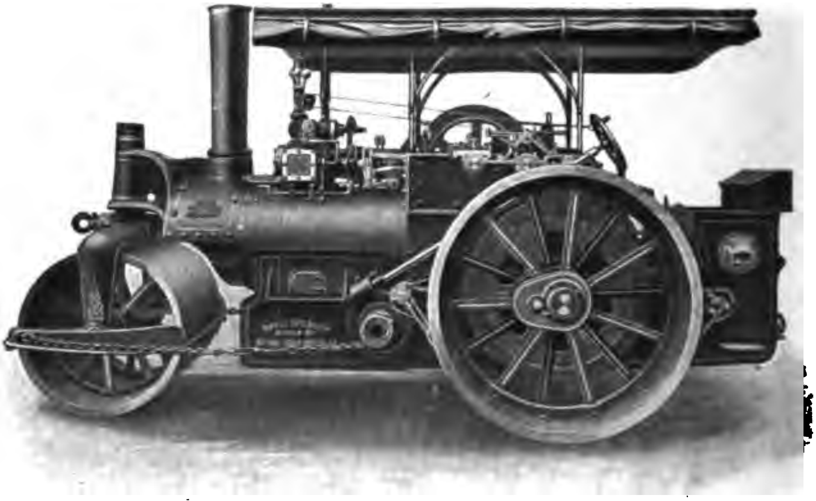

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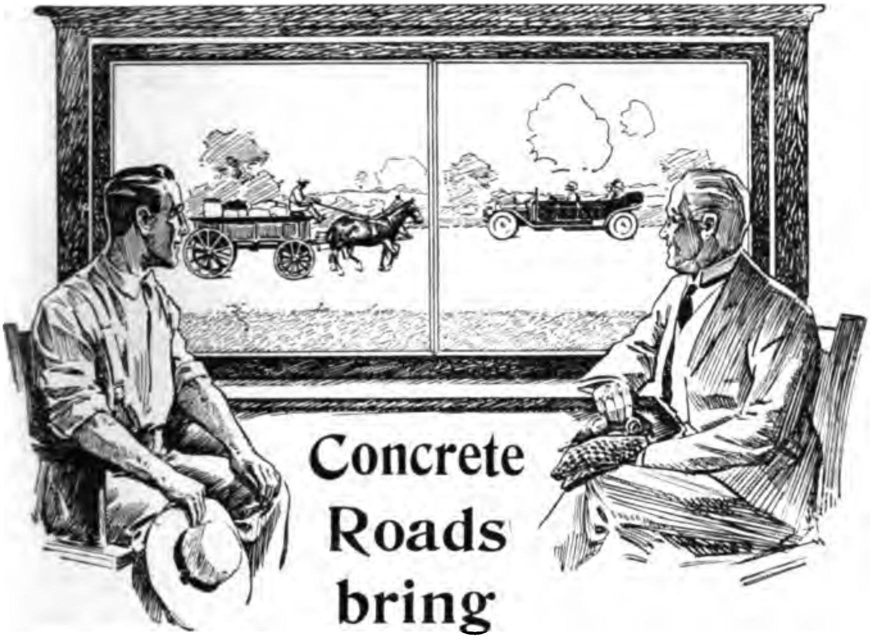

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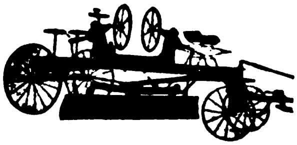

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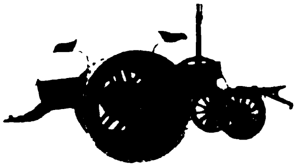

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(Read article on Asphalt Block, page 127)

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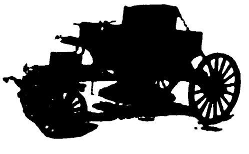

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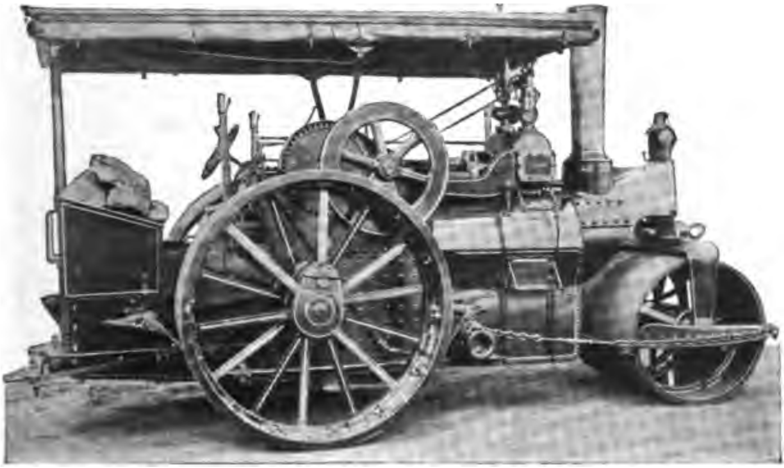

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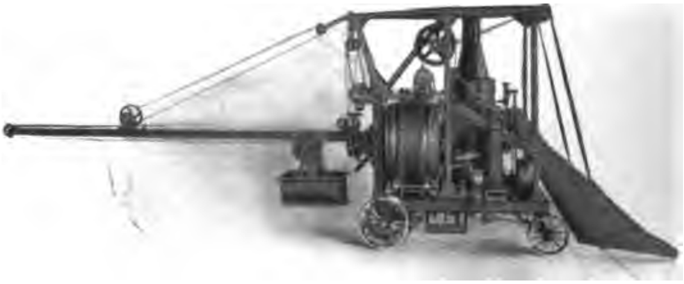

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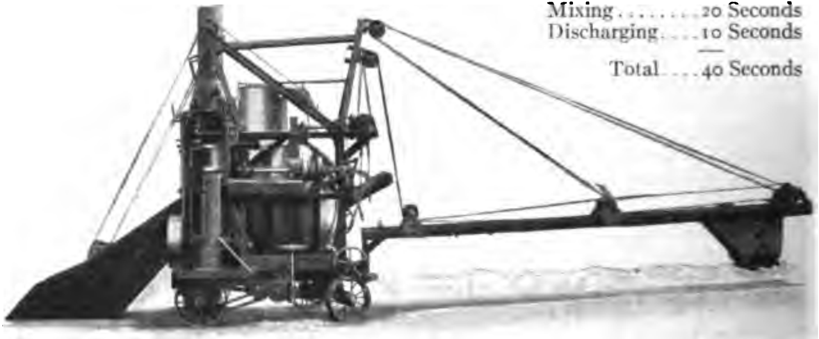

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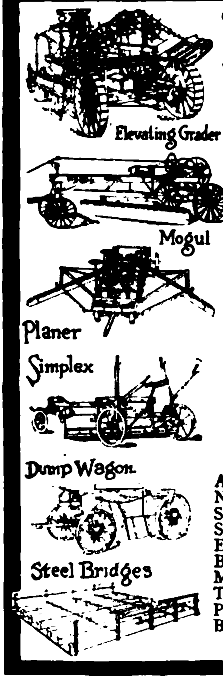

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THE Russell line is represented in every part of the country by thousands of machines which are demonstrating their genuine merit. The Russell invites comparison with any other line of earth-handling machines. In fact it is by comparison that the worth-while advantages of the Russell are most clearly pioven. The Russell policy of making each machine the most complete and efficient for its purpose wins everywhere.

There is a Russell Machine for Every Class of Work

For grading, excavating, conveying, ditching, grading and leveling, irrigating, drainage, etc.—practically every kind of earth-handling work, the Russell Line offers you the very best service. Elevating Graders, Road Machines of all sizes, Buck Scrapers, Wheel and Drag Scrapers, Road and Railroad Plows, Road Drag, Road Scarifiers, Dump Wagons, Culverts, Steel Bridges, etc.

Our 80-Page Catalog Free

The new Russell Catalog should be in the hands of every Contractor. It is a most complete book, dealing with earth-handling machines. Contains also general information which is very valuable, such as cost of moving fixed amounts of earth, methods of doing various kinds of ditching, road building, etc. Write for it today:

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General Office and Factory:
2207-29 University Ave., S. E., Minneapolis, Minn.

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Philadelphia, Pa.—Empire Bldg.
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MEDUSA PRODUCTS

Are being used in all parts of the world and under all conditions, and have been found

EFFECTIVE—ECONOMIC—SATISFACTORY

MEDUSA GRAY PORTLAND CEMENT

Celebrated for its uniform color and strength and guaranteed to pass and surpass standard specifications. Over 100,000 barrels used by U. S. Government in breakwater at Cleveland, O.

MEDUSA STAINLESS WHITE PORTLAND CEMENT

The first true white Portland ever manufactured. Being used by U. S. Government in work on the Panama Canal and in many public buildings.

MEDUSA WATERPROOFING

Makes concrete absolutely impervious to water and prevents discoloration and efflorescence. Not a wash or an experiment.

Write for descriptive booklets, samples and prices

SANDUSKY PORTLAND CEMENT CO. **Sandusky, Ohio.**

SARCO

That Label is a Positive Guarantee of Quality

SARCO paving asphalts and road binders are made from the purest natural asphalt in the world—Utah Gilsonite—and the best quality of Asphalt Flux.

We own and operate the largest plant in the world for producing superior quality refined asphalts. We use only the most select quality of Gilsonite and our asphalt flux is refined under our own supervision.

SARCO paving asphalts and road binders are furnished in any desired consistency, ductility or melt point. They are delivered ready for use and do not require the addition of a softening agent at the paving plant. Each shipment is guaranteed to strictly conform with the specifications under which it is sold and the material to be of absolutely uniform quality.

TO MUNICIPAL OFFICIALS:—

If you are seeking a better quality of asphalt for your pavement work we would be pleased to submit for your consideration complete and convincing evidence of the superiority of our SARCO paving asphalts. This evidence is in the nature of the records of pavements now in use and opinions of experts qualified to render judgment.

TO CONTRACTORS:—

We solicit inquiries from responsible contractors who desire to purchase high grade refined asphalt for paving work at a price that is right.

On account of our light shipping package we deliver almost a net ton of material for each gross ton shipment. This feature means a big saving on large contracts.

We would be pleased to submit information and data on any of our paving asphalts and also asphalts for Roofing, Water-Proofing, Asphalt Floors, Insulation, etc.

Send for our booklet *SARCO Asphalt Products and Their Uses.*

Form 107 S

Standard Asphalt & Rubber Co.

CHICAGO, ILL.

STANDARD OIL COMPANY
(NEW JERSEY)

Manufacturers of

STANDARD ROAD OILS

STANDARD MIXING ASPHALT

STANDARD ROAD BINDERS

STANDARD PAVING ASPHALT

Character of surface secured after treating gravel or macadam road with BINDER "A" applied hot and covered with grits or screenings.

Roads of every description successfully treated with our well known ASPHALT ROAD OILS AND BINDERS.

Asphalt pavements to withstand the heaviest traffic constructed with STANDARD PAVING ASPHALT.

Specifications for all types of construction sent upon request.

STANDARD OIL COMPANY
(New Jersey)
Road Oil and Asphalt Dept.

26 Broadway, N. Y.
Baltimore, Md.

COMPACT your sub-grade with a "Sheepsfoot" rolling tamper and save money.

WHEN the tamping roller is properly used there will be no "soft spots" in the base to develop into "holes" on the surface.

SAND-CLAY roads become as "hard as rock" when built with the tamping roller.

"With team and driver at 50 cts. per hour, a subgrade can be plowed, harrowed, sprinkled and tamped for less than 4 cts. per sq. yd., and this provides a liberal allowance for hard plowing and clodbreaking; the tamping alone costs only 1⅓ cts. per sq. yd. as a maximum, so that there are many soils where plowing, sprinkling and tamping cost less than 2 cts. per sq. yd.

When one remembers that a square yard of macadam 6 ins. thick rarely costs less than 60 cts., the great economy of properly consolidating the subgrade for macadam is apparent, for a 2-in. reduction of thickness of macadam causes a saving of 20 cts. per sq. yd.

A 6-in. base of concrete seldom costs less than 70 cts. per sq. yd., so that a saving of only 2 ins. in its thickness means a reduction of 23 cts. per sq. yd.

The writer is satisfied that, so far as thickness needed for wheel load distribution is concerned, 3 ins. of macadam or concrete on a properly prepared and tamped earth sub-grade is sufficient in most cases."

—Extract from an editorial article in Engineering-Contracting, June 9, 1909.

MANY OTHER road building tools for up-to-date road builders. If interested write to

Southern Branch Petrolithic Company,
620 Maison Blanche, New Orleans, La.

STANDARD
Refined
Mexican Asphalt

Prepared in various grades for

Sheet Asphalt Pavements

and

Bituminous Macadam Road Construction

by either the penetration or mixing method.

Standard Asphalt Road Oil

Containing from 40% to 60% asphaltum, to keep down dust.

Specifications and other particulars on application.

STANDARD OIL COMPANY OF NEW YORK

Road Oil Department **26 Broadway, New York**

WAINWRIGHT STEEL-BOUND CONCRETE CURB

HAS A RECORD OF SIXTEEN YEARS' USE WITHOUT A FAILURE

"WAINWRIGHT PATENTS"
March 9, 1897
November 22, 1898
May 5, 1903
March 26, 1907
August 29, 1907
August 2, 1910

Absolutely Non-Breakable

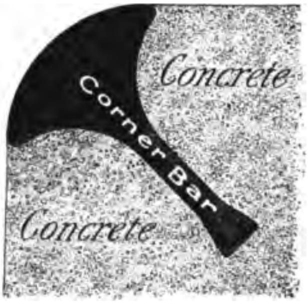
CHEAPER THAN GRANITE

OVER SIX MILLION FEET

IN USE IN MORE THAN

FOUR HUNDRED CITIES

IN THE UNITED STATES



This curb will stand harder use and last ten times as long as plain concrete curbing

The Wainwright Galvanized Steel Corner Bar

IS THE ONLY BAR THAT CAN BE DEPENDED ON TO PERMANENTLY RETAIN ITS PLACE IN CONCRETE

The superiority of the Wainwright Galvanized Steel Corner Bar is due to the solid rounded head with dovetail web, making continuous integral anchorage.

FROST WILL NOT DISPLACE THE WAINWRIGHT BAR, AS IT WILL ANY BAR ANCHORED AT INTERVALS

METAL PARTS FOR SALE. SEND FOR COPYRIGHTED BOOKLET No. 8.

STEEL PROTECTED CONCRETE CO. REAL ESTATE TRUST BLDG.
PHILADELPHIA, PA.

SILICA ROAD PEBBLE
For the
"WEAR" in Bituminous Road Tops
THE PORTAGE SILICA CO.
YOUNGSTOWN, OHIO

PAVING BRICK
Repressed, Wire-Cut-Lug
SOUTHERN CLAY MFG. CO.
CHATTANOOGA, TENN.

SPOTTISWOODE-CUSACK CO.
Coal—Lumber—Masons' Materials
Crushed Stone for Concrete Road Making and Repairs

Office:
181 Essex Avenue
and D.L.&W.R.R.
Phone 32

Masons' Materials—Lumber:
241 Washington Street
and Erie Railroad.
Phone 3633

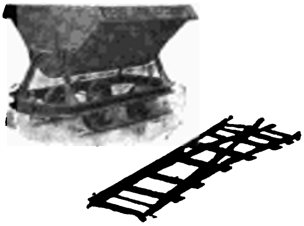
ORANGE, N. J.

THE UNITED BRICK COMPANY
Wire Cut Lug Paving Block

Works:
Conneaut, Ohio

General Office:
Greensburg, Pa.

Good Roads at Low Cost



Koppel

Cars, Track, Switches
—For Rent—
-For Sale-
Write for
Catalog

ORENSTEIN-ARTHUR KOPPEL CO.

Works:
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Other Offices:
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Specify TEXACO and BE SURE

TEXACO ROAD PRODUCTS are notable for their uniformity. This means consistency. In other words any one of the products used under the same conditions gives the same results.

On roads throughout the country they are demonstrating their fitness to cope with traffic conditions, and their adaptability to climatic changes.

Engineers, contractors and tax payers in localities as divergent in requirements as New York, Texas, Montreal, or Florida, have expressed their appreciated confidence in Texaco Road Products.

THE TEXACO FAMILY IS:

Texaco Road Oil
Texaco Liquid Asphalt
Texaco Macadam Binder
Texaco Road Asphalt
Texaco Paving Filler
Texaco Paving Cement

The proper use of these products brings with them the certainty of economy.

Specify TEXACO and BE SURE

We shall be pleased to receive any inquires as to prices, specifications or requests for information of any sort.

THE TEXAS COMPANY

PAVING AND ROADS DIVISION

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BRANCH OFFICES

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Philadelphia
Chicago
Norfolk
Atlanta
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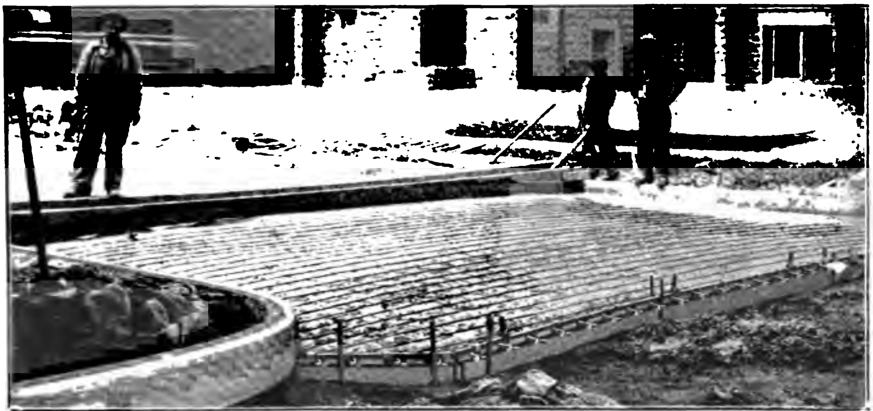

Concrete Pavement, Detroit, Mich. Expansion Joints protected with TRUS-CON ARMOR PLATES
Concrete reinforced with RIB METAL, note how flat the sheets lay without fastening
Concrete Curbs protected with TRUS-CON CURB BARS

TRUS-CON ARMOR PLATES

The Most Efficient Expansion Joint Protector

Two solid steel plates that protect the edges of expansion joints in concrete pavements from chipping and breaking down under traffic. Very easy to install to perfect line and grade. Anchored securely to concrete base by specially hooked prongs and wear evenly with road surface. Curved to pitch or crown of pavement in any lengths.

RIB METAL reinforces concrete pavements against frost heaves and cracks caused by settlement of sub-soil. Consists of a series of straight bars rigidly connected by cross members formed from the same sheet of steel. Two men can handle and place 128 sq. ft. of RIB METAL reinforcement as easily as they would handle a single bar. There is no unrolling of coils, no cutting to length, nor special labor to hold steel in place.

TRUS-CON CURB BARS are substantial galvanized steel plates that protect the greatest area of exposed edge of concrete curbs. Anchored absolutely by rigid bolts which do not split the concrete Very simple to install, no special tools or detached parts required.

FREE! VALUABLE PAMPHLET ON CONCRETE PAVING—Contains complete information and illustrations on pavement reinforcement and protection of expansion joints and concrete edges.

KAHN Building Products TRUSSED CONCRETE STEEL CO

Trussed Concrete Steel Co.

1039 Trussed Concrete Building Detroit, Michigan

Reinforcing, Hy-Rib & Lath, Steel Sash, Etc.

WHAT COUNTS?

THE SERVICE TEST

UNION
and MALTHA
Brand Asphalts have
passed the Service Test
in hundreds of pavements
throughout the North American continent during
the past twenty
years

UNION OIL COMPANY OF CALIFORNIA

General Sales Offices
SAN FRANCISCO

Distributing Stations
NEW YORK
CHICAGO
AND ALL PRINCIPAL CITIES

U. S.

Wood Block Pavement

Courtyard of New Orleans Gas Light Company, Showing Wood Block Pavement

A Wood Pavement That Lasted Thirty-Two Years

Thirty-two years ago the New Orleans Gas Light Company paved a portion of their courtyard with creosoted wood blocks. The courtyard was used as a driveway and has had steady wear.

It has never been repaired on account of wear and is a perfect pavement to-day. How much longer it will last without repairs no one can predict until some wood block pavement somewhere actually wears out.

Wood blocks laid with the grain vertical cannot split or be crushed. The only effect of traffic upon them is the hammering down and matting of the end fibres of the wood. This process makes the surface so hard that, after the first year, no wear is discernible. The pavement practically makes itself traffic-proof.

Wood Block pavement is the only pavement of which this is true. Wood Block pavement is to be recommended wherever heavy traffic necessitates long-lived pavement.

Wood Block pavement is to be recommended for streets where quietness is desirable, as, for instance, in office-building districts, on residential streets and around hospitals, schools, courts, etc.

Wood Block pavement is to be recommended for the main "show streets" of towns, for silence is the greatest beauty a pavement can have.

Wood Block pavement is to be recommended for bridges, because it is the only durable light-weight pavement. Also for shop floors, track paving, courtyards, private driveways, etc.

Booklet with Further Information on Request.

U. S. Wood Preserving Co., 165 Broadway, New York

AZTEC
ASPHALT

Aztec is a genuine Asphalt Product, without the admixture of any inferior materials. It is refined by careful and scientific processes which produce an asphalt thoroughly uniform in character and which passes the highest tests in every essential qualification necessary to a high grade asphalt.

AZTEC LIQUID ASPHALT

(FOR OILING ROADS)

Preserves the Roadway Equally Successful
when Applied to Macadam, Dirt,
Sand or Gravel

THE INTEROCEAN OIL CO.

THE
UNITED STATES ASPHALT
REFINING CO.

90 WEST STREET, NEW YORK

CHICAGO PHILA. BALTO. NORFOLK
MONTREAL

BUSY ALL THE TIME

Your Teams will do One-third More Work—Less Labor—Fewer Wagons—Save $6.00 per Car.

Buy Two Quick
Unloading Car Chutes

Write me for Prices on Contractors' Equipment

THOS. M. ROCHE
Road Building Materials
and Machinery

They Will Cost You Less
Than One Dump Wagon

Western Sales Agent for "Aztec Asphalts." See Opposite Page

Chicago Agent
for Rapid Mixers

829-830 Monadnock Bldg.
CHICAGO, ILL.

ISHAM RANDOLPH & CO.
CONSULTING ENGINEERS
1827 Continental Bank Bldg.,
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1310 Heard Bank Bldg.,
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J. Beverley Robinson W. O. Ross
ROBINSON & ROSS
Iron Slag Paving Brick
(NEAT—SANITARY—DURABLE)
16 Exchange Place NEW YORK

Jos. Soisson Fire Brick Company
VITRIFIED PAVING BLOCKS
IMPERVIOUS FACE BRICK
HIGH GRADE SILICA AND FIRE BRICK
General Offices: CONNELSVILLE, PA.
Sales Office: BOLIVAR, PA.

STERLING BRICK COMPANY
Manufacturers of
Vitrified Paving Blocks
OLEAN, NEW YORK

VULCANITE PORTLAND CEMENT
"THE BRAND WITH A REPUTATION"
SLOW SETTING—RAPID HARDENING
SOUND—UNIFORM—GREAT STRENGTH

Floating Surface from Bridge, Chevy Chase, Md.
Concrete Road Built 1912 with Vulcanite Portland Cement
INCORPORATED 1893
VULCANITE PORTLAND CEMENT CO.
Land Title Bldg., PHILADELPHIA 200 5th Ave., NEW YORK

Traffic Conditions Demand Hard, Permanent Roads

Every road must be built for its traffic. Time was when macadam roads were good roads—before the days of motor travel. Now the steady grinding of heavy cars gouges macadam into ruts; the constant suction of motor car wheels rips the binder from the surface.

Concrete Roads

stand up under the wear of heavy motor traffic. Weather conditions do not affect them. Freezing does not make the binder brittle, heat does not soften it. The surface is smooth, hard and dustless; the road is permanent.

If you are interested in good roads, send for our free booklet on the use of concrete in road construction.

UNIVERSAL PORTLAND CEMENT CO.
CHICAGO - PITTSBURGH - MINNEAPOLIS

Plants at Chicago and Pittsburgh—Annual Output 12,000,000 Barrels

RELIANCE

This word stands for the best road machinery in the world. It means quality, service, satisfaction. It stands as a protection to the buyer, for we back every piece of machinery that leaves our factory. It means in road machinery what honesty, integrity and faithfulness mean in a man.

For selfish reasons you ought to investigate our line. You may not save money on the first cost but when it comes to maintenance, convenience in handling and uninterrupted service, the figures will show on the right side of the ledger.

The illustration shows a complete Reliance portable stone crushing outfit—Capacity 150 tons per day. We build our crushers in sizes from 8 x 14 to 12 x 24 inches jaw opening with capacities from 70 to 250 tons per day. Reliance portable bins are built in 12, 15, 20, 25, 30, 40 and 50 tons capacities.

The Reliance Sweeper weighs just 2000 lbs. The mechanism is held in positive alignment, the broom may be positively and accurately adjusted. Contractors and towns owning several makes of sweepers pronounce the Reliance the best.

The Porcupine Scarifier will pay for itself on one job. 4000 square yards is an average day's work on macadam roads. It may be adjusted to scarify evenly to any desired depth up to eight inches. Figure out for yourself what you can save.

Don't wait until you are in the market to investigate—you may forget—write now for our literature and prepare yourself to purchase wisely.

UNIVERSAL ROAD MACHINERY CO., Kingston, N. Y.

BOSTON, MASS. HARRISBURG, PA. ROCHESTER, N. Y.

F. H. HOPKINS & CO., Montreal, Canada
W. L. CLEVELAND CO., Los Angeles, Cal.
H. H. MEYER CO., Baltimore, Md.
RUBERT M. GAY CO., New York, N.Y.

KYROCK

KENTUCKY NATURAL ROCK ASPHALT

"KyrocK" Macadam (Cold).
Using Kentucky Rock Asphalt "Cold" as a Binder and Wearing Surface on a broken stone foundation.

"KyrocK" Macadam (Hot).
Using Kentucky Rock Asphalt "Hot" as a Binder and Wearing Surface on a broken stone foundation.

"KyrocK" Concrete (Hot).
Using Kentucky Rock Asphalt "Hot" and broken stone mixed in a Hot Mixer and laid on a broken stone or concrete foundation.

WRITE FOR BOOKLET AND FURTHER INFORMATION

THE WADSWORTH STONE & PAVING COMPANY
PITTSBURGH, PA.

WARRENITE

Some Things You Should Know About the Warrenite Road Surface

Warrenite is the most successful road surface that has yet been devised, and is far superior to all other forms of bituminous road surfaces.

Warrenite, Cromwell Road, Cromwell, Conn.

Warrenite stops maintenance expense.

Warrenite is a sanitary, dustless, noiseless surface.

Warrenite saves the wear and tear of motor and horse vehicles.

Warrenite beautifies and enhances the value of abutting property.

Warrenite prevents automobiles from skidding and insures a secure foothold for horses.

Warrenite can always be had at a reasonable cost under the mixture agreements filed with the proper authorities.

The State of Connecticut alone has over 57 miles of **Warrenite** roads; other states bring total to 306 miles.

The experience of these states should satisfy you that **Warrenite** is the "best by every test."

Warrenite is not an oil coating for macadam roads but is a permanent surfacing which is composed of varying sizes of the best stone obtainable scientifically mixed with bituminous cement, laid and rolled while still hot, the fine particles of stone filling the voids and giving the surface the inherent stability a permanent country road surface requires.

Why not investigate **Warrenite** before spending vast sums of money experimenting on your country roads?

Write today for **Warrenite** circular, specifications and form of mixture agreement available to all contractors and learn more about this modern permanent ideal country road surface.

WARREN BROTHERS COMPANY

Executive Offices: 59 Temple Place, Boston, Mass.

District Offices:

New York, N. Y.
50 Church St.

Chicago, Ill.
10 So. LaSalle St.

Rochester, N. Y.
303 Main St. West

Los Angeles, Cal.
926 Calif. Bldg.

Portland, Oregon
Journal Bldg.

Phoenix, Arizona
204 Noll Bldg.

THE WESTRUMITE COMPANY
WHITING, INDIANA

E. 12th Street, Cleveland, Ohio
2" Asphaltic Concrete Wearing Surface Over Old Brick Pavement

WESTRUMITE ASPHALT—LAID COLD
No heating machinery. Most easily maintained and repaired
Most economical on small as well as large work.

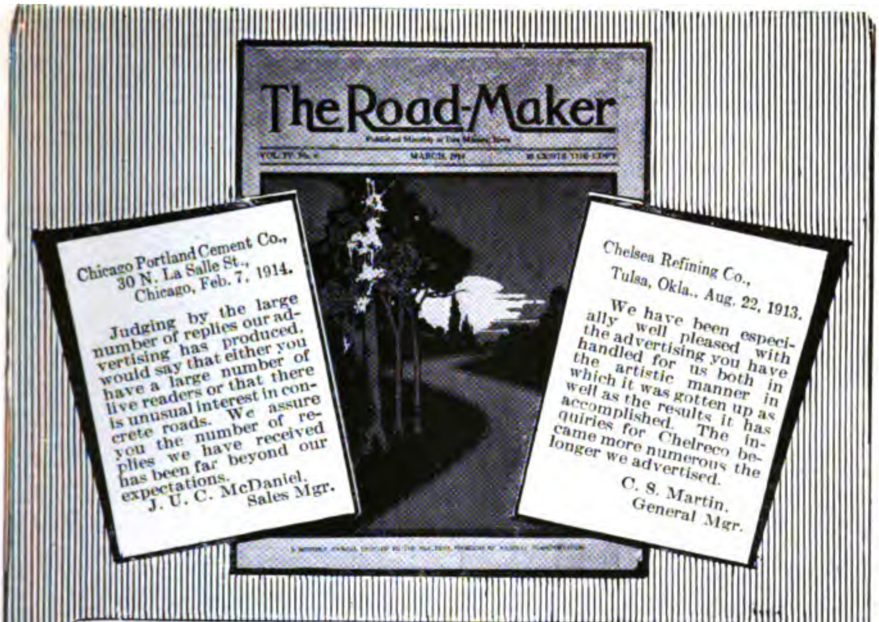
THE OREGONIA BRIDGE COMPANY
Incorporated
BRIDGE & STRUCTURAL WORK
LEBANON, OHIO

THE THORNTON FIRE BRICK COMPANY
VITRIFIED PAVING BLOCK
HIGH GRADE FIRE & BUILDING BRICK
GROUND FIRE CLAY
D. R. POTTER, Gen'l Mgr. CLARKSBURG, W. VA.

FACTORIES { TRIMBLE, O. GLOUSTER, O.
THE TRIMBLE PAVING BRICK CO.
800-801 U. B. Building
DAYTON, OHIO.

THE WEBSTER BRICK COMPANY
Manufacturers of
"SOUTH WEBSTER BLOCK"
SOUTH WEBSTER, OHIO

The Wolverine Portland Cement Co.
COLDWATER, MICH.
WOLVERINE
HAS NO SUPERIOR FOR ROAD WORK
THERE'S NONE BETTER



Chicago Portland Cement Co.,
30 N. La Salle St.,
Chicago, Feb. 7, 1914.

Judging by the large number of replies our advertising has produced, would say that either you have a large number of live readers or that there is unusual interest in concrete roads. We assure you the number of replies we have received has been far beyond our expectations.

J. U. C. McDaniel,
Sales Mgr.

Chelsea Refining Co.,
Tulsa, Okla., Aug. 22, 1913.

We have been especially well pleased with the advertising you have handled for us both in the artistic manner in which it was gotten up as well as the results it has accomplished. The inquiries for Chelreco became more numerous the longer we advertised.

C. S. Martin,
General Mgr.

Why Our Business Doubles Each Year

The growth of The Road-Maker has been one of the most remarkable events in recent journalism. Starting in a new field, as a business enterprise, wholly independent of any organization, association or business connection, it has built up a large and exceptionally high-class advertising patronage. The secret can be told briefly. We have made

The Road-Maker

"The Magazine of the Highway Official"

This is true in more ways than one. We have made it a necessity to every highway official and road worker in the Great Black Dirt Belt of Iowa, Minnesota, Wisconsin, Illinois, Missouri, Kansas, Nebraska, North and South Dakota. In addition to making it a necessity to these men, we have secured them as regular readers. The March, 1914, edition went to approximately 25,000 subscribers of whom more than 18,000 were highway officials. That is why it produces results and results are responsible for the fact that 1914 shows 100 per cent increase over 1913 which made a similar record as compared with 1912.

Write Today for Sample Copy and Rates

The Road-Maker Company
Des Moines, Iowa

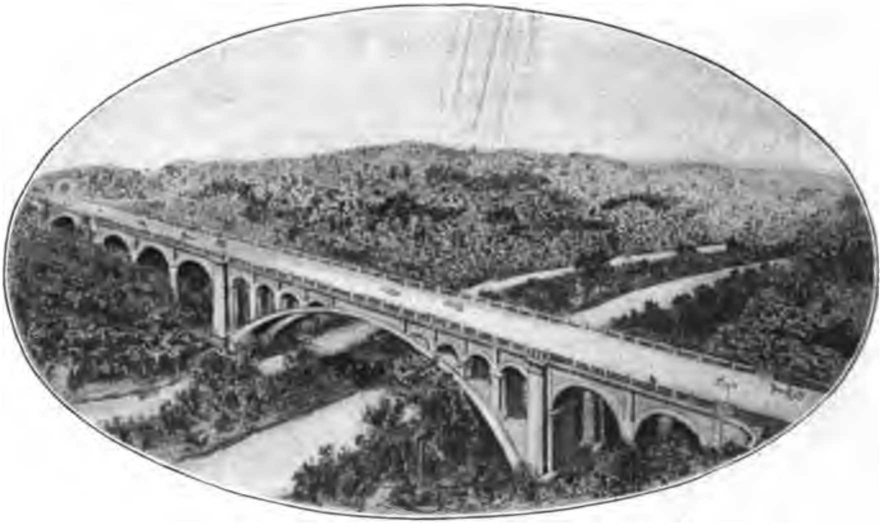
WHITEHALL PORTLAND CEMENT

TO BEAT WHITEHALL

USE WHITEHALL

Walnut Lane Bridge

Philadelphia, Pa.



WHITEHALL CEMENT MANUFACTURING CO.

PHILADELPHIA, PA.

Capacity 1,500,000 Barrels

Most Modern Cement Plant in the United States

CAST IRON PIPE CULVERTS

6 inches to 6 feet

Do not **rust** out
Do not **rot** out
Do not **wear** out
Do not **wash** out

When you use a Culvert of

there is no waiting—fill in and the job is done—to last forever

Always in stock at the foundries of any of the following companies—all independent and competing makers of

Cast Iron Pipe:

American Cast Iron Pipe Co.
Birmingham, Ala.
James B. Clow & Sons,
Chicago, Ill.
Donaldson Iron Co.
Emaus, Lehigh Co., Pa.
Glamorgan Pipe & Foundry Co.
Lynchburg, Va.

Lynchburg Foundry Co.
Lynchburg, Va.
Massillon Iron & Steel Co.
Massillon, Ohio.
Standard Cast Iron Pipe & Foundry Co.
Bristol, Pa.
R. D. Wood & Co.
Philadelphia, Pa.

THIS AMERICAN INGOT IRON ARMCO CULVERT

is entering upon its second period of usefulness. See what the man who installed it has to say:

Alhambra, Calif.,
Sept. 23, 1913.

California Corrugated Culvert Company,

Dear Sirs:—I assisted in placing a 24" American Ingot Iron Culvert under the Garvey Road in June, 1907, and because of changes in drainage it was necessary to take the culvert out, this spring, and there was built at that place a concrete arch about eight by seven feet.

About five hundred yards west on Garvey Road we needed some 24" pipe, and your pipe was in such good shape we put it in at that point, under a deeper fill than before.

The pipe when removed showed hardly any sign whatever of having been in use for six years, and knowing as I do of the sand and gravel which this pipe had to carry, I consider its condition remarkable. The pipe looks as good as new—I would just as soon have this pipe as a new one.

Yours truly,
(Signed) LEE L. PAGE,
Acting Road Foreman, Alhambra Dist.,
Los Angeles County.

Write to the Nearest Manufacturer for Particulars and Prices on American Ingot Iron Corrugated Culverts, Plates, Sheets, Roofing and Formed Products.

Arkansas, Little Rock
Dixie Culvert & Metal Co.
California, Los Angeles
California Corrugated Culvert Co.
California, West Berkeley
California Corrugated Culvert Co.
Colorado, Denver
R. Hardesty Manufacturing Co.
Delaware, Clayton
Delaware Metal Culvert Co.
Florida, Jacksonville
Dixie Culvert & Metal Co.
Georgia, Atlanta
Dixie Culvert & Metal Co.
Illinois, Bloomington
Illinois Corrugated Metal Co.
Indiana, Crawfordsville
W. Q. O'Neall Co.
Indiana, Princeton
W. Q. O'Neall Co.
Iowa, Des Moines
Iowa Pure Iron Culvert Co.
Iowa, Independence
Independence Corrugated Culvert Co.
Kansas, Topeka
The Road Supply & Metal Co.
Kentucky, Buechel
Kentucky Culvert Co.
Louisiana, New Orleans
Dixie Culvert & Metal Co.
Maryland, Havre de Grace
Spencer, J. N.
Massachusetts, Palmer
New England Metal Culvert Co.
Michigan, Bark River
Bark River Bridge & Culvert Co.
Michigan, Lansing
Michigan Bridge & Pipe Co.
Minnesota, Minneapolis
Lyle Corrugated Culvert Co.
Minnesota, Lyle
Lyle Corrugated Culvert Co.
Missouri, Moberly
Corrugated Culvert Co.
Montana, Missoula
Montana Culvert Co.
Nebraska, Lincoln
Lee-Arnett Co.
Nebraska, Wahoo
Nebraska Culvert & Mfg. Co.
Nevada, Reno
Nevada Metal Mfg. Co.
New Hampshire, Nashua
North-East Metal Culvert Co.
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Pennsylvania Metal Culvert Co.
New York, Auburn
Pennsylvania Metal Culvert Co.
North Carolina, Greensboro
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North Dakota, Wahpeton
Northwestern Sheet & Iron Works
Ohio, Middletown
American Rolling Mill Co.
Ohio Corrugated Culvert Co.
Oklahoma, Shawnee
Dixie Culvert & Metal Co.
Oregon, Portland
Coast Culvert & Flume Co.
Pennsylvania, Warren
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South Dakota, Sioux Falls
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HIGHWAY BRIDGES AND CULVERTS

The proper material to be used in the construction of a bridge or culvert depends almost wholly on local conditions, such as area of waterway required, character and amount of traffic, available funds, etc. For bridges of considerable span, steel is commonly used, though long arches of concrete, stone or brick are not unusual. For the shorter spans up to 30 or 40 feet, reinforced concrete is well adapted. Culverts are built of various materials, such as stone, brick, concrete, and pipe of cement, vitrified clay, corrugated iron, or cast iron. Wood is also frequently used, but the high cost of maintenance, and the inconvenience and discomforts attending periodic repairs or renewals make it a very undesirable material of which to construct highway bridges or culverts, and its use should be avoided.

Steel Bridges

Because of its toughness and great unit strength, steel is peculiarly well adapted for use in bridge construction. Cast and wrought iron were formerly much used for this purpose, but in recent years have been generally supplanted by steel.

A complete discussion of the subject of steel bridges would occupy too much space to be undertaken here. There are a few essential details, however, which may be profitably pointed out.

Design

The design of steel bridges is now almost an exact science, and most of the bridge companies doing business in this country are amply equipped for executing designs under any reasonable set of conditions that may be imposed. It is obviously bad practice, however, to invite bids for furnishing and erecting a proposed bridge from these companies upon their own plans, without first having prescribed a complete and definite set of conditions to which the designs must conform. Otherwise, in the absence of a standard of excellence, no adequate comparison can be made of the bids received. Also, irresponsible parties are likely to secure the contract by submitting low bids with very light designs. Provision should always be made for having bridge designs checked by a competent, disinterested designer.

Loading

The loading which a highway bridge should be designed to sustain depends in general on the local traffic conditions. Due allowance, however, should always be made for reasonable increases both in the amount of traffic and in the weight of concentrated loads. For rural bridges it is usually sufficient, in designing the floor system, to provide for a uniform live load of 125 pounds per square foot, or for a load of 20 tons concentrated on two axles 10 feet apart, with wheels spaced 6 feet on axles and with two-thirds of the load on the rear axle. In designing the trusses the uniform live load may be safely assumed as follows: For spans less than 50 feet in length, 125 pounds per square foot of floor surface; for spans between 50 and 100 feet in length, 100 pounds per square foot of floor surface; while for spans greater than 100 feet in length, the assumed uniform live load per square foot of floor surface may be reduced 2 pounds for each additional 10 feet in length of span, provided that in no case should the assumed uniform live load be less than 80 pounds per square foot of floor surface.

Piers and Abutments

A large percentage of the bridge failures in this country have been due to umproperly designed abutments. There seems to be a general tendency to confuse the design of abutments with that of piers, and it is not unusual to see a bridge, consisting of a single span, supported on four slender cylindrical piers with no other provision for restraining the material of the approach embankment than wooden boards resting against these piers. There can be no objection to the use of properly designed cylindrical piers for supporting intermediate spans; but the abutment must serve a dual purpose. It is required to support the bridge and also to act as a retaining wall for the approach; and both of these functions should be considered in making the design.

Foundations for Piers and Abutments

In designing piers and abutments, the size of the footings should usually depend on the character of the foundation material. Investigations should, therefore, be made in the vicinity of each pier or abutment before the design is completed. The foundation may be tested by sounding with rods, by boring with wood augers, by sinking pipes with water jets or by drilling with a percussion drill.

When the character of the foundation material has been determined, its safe bearing capacity may be estimated from the following table, taken from U. S. Office of Public Roads Bulletin No. 43.

Material	Bearing power (tons per square foot)
Quicksand and wet soils	0.05 to 1
Dry earth	1 to 1.5
Moderately dry clay	2 to 4
Dry, stiff clay	4 to 6
Sand	2 to 4
Sand, compact and cemented	4 to 6
Gravel, cemented	8 to 10
Rock	200

Where the material of the foundation is poor, as, for example, wet clay or quicksand, it is customary to increase its bearing power by making use of piles, which are driven to such depth as is necessary to prevent settling after the weight of the whole structure is superimposed, the piles being considered as carrying the entire load. The formula in most general use for determining the amount of driving necessary to produce this condition is that proposed by the *Engineering News*, $P=\frac{2WH}{S+}$, in which P is the safe load in pounds on one pile, W the weight of the hammer in pounds, H the fall of the hammer in feet, and S the penetration or sinking in inches under the last blow.

2000 × 10

20000
1
1

Floors

Highway bridge floors are made of wood, reinforced concrete or steel. Wood floors are probably the most common, but reinforced concrete presents many advantages over wood for this purpose, and is becoming very popular. Wood floors on old bridges, however, should never be replaced by concrete, unless the change was anticipated in the original design. Neither should the thickness of the wood floor be much increased, as any additional weight put on the structure for which provision has not been made is likely to prove disastrous.

The economical thickness of wood floors depends on traffic and climatic conditions, as well as on the quality of the wood. In general, it should be such that the wood will have practically worn out before being destroyed by decay. This economical thickness varies from 2½ to 4 inches.

Concrete or steel floors should always be protected from the traffic by cushion of earth or macadam.

Painting

Steel bridges should ordinarily be repainted about once every three years. If this work is neglected, as is so frequently the case, rust soon makes inroads into the metal, impairing both its strength and appearance.

Concrete Bridges and Culverts

Concrete bridges and culverts should be designed to sustain the same live loads as those indicated above for steel bridges.

The proper type of superstructure to adopt for any particular case should usually depend on local conditions. For example, where sufficient head room and satisfactory foundation can be obtained, an arch may be advantageously used. Where head room is limited or the foundation poor, however, it may frequently be necessary to make the superstructure flat. Also, flat slab superstructures are ordinarily used for spans less than about 14 feet in length, as little, if any, saving can be effected by using an arch. Where appearances are of prime consideration, however, an arch may properly be used, even at additional cost.

There are three types of flat reinforced concrete superstructures in general use which are respectively known as the slab type, the encased I-beam type, and the T-beam type. Each of these types may be used with either stone or concrete abutments.

The slab type is practicable only for spans less than about 16 feet in length. Culverts and bridges of this type are very easily constructed, and require very little skilled labor.

The encased I-beam type of superstructure is well suited for spans from 10 feet to 30 feet in length. In this type, the steel beams are designed to carry the entire load, though the concrete casing undoubtedly increases the strength of the structure.

The T-beam type is adapted for about the same range of spans as the I-beam type, though T-beams can be used for somewhat longer spans. When used for spans over 30 feet in length, however, the economy of employing them should be demonstrated for each particular case. The construction of T-beam bridges and culverts is more difficult than either of the other types and requires more skilled labor. The cost of materials, however, is, in general, somewhat less.

The accompanying illustrations, which have been prepared from data contained in Bulletin No. 45 of the U. S. Office of Public Roads, show how the various types of concrete superstructures are designed, and also show typical designs for a 4 foot by 3 foot box culvert, and a 10 foot span slab bridge on stone abutments.

Specifications for reinforced concrete bridge and culvert construction are contained in U. S. Office of Public Roads Bulletin No. 45, which may be had upon application to the Director of that office.

Pipe Culverts

Vitrified clay, cast iron, corrugated iron, steel plate and cement pipes are used for the smaller culverts. Up to 24 inches in diameter pipe culverts are usually economical and the pipes are easily handled and laid. They should be laid true to grade and on a firm foundation. Headwalls of concrete, brick or stone should be constructed at each end, extending high enough to carry the fill and low enough to avoid damage by frost.

Cast Iron Pipe Culverts

Cast iron pipe has been satisfactorily used for culverts for many years, and while not as cheap per foot, nor as easily handled as some of the lighter metal culverts, its claim to durability can not be questioned. Some of the cast iron pipe culverts placed in Paris over three hundred years ago are still in service and apparently in a fair state of preservation.

Cast iron pipe for highway culverts is usually made in 12-foot lengths, and can be obtained in various diameters from foundries in almost every part of the country.

Sectional Cast Iron Culverts

The sectional cast iron culverts possess features which tend to make them desirable in highway work. With their flattened oval base, they are said to have greater freedom from clogging. Their locked joints holds them intact. It is claimed that their headwalls hold the roadbed in shape thus allowing a shorter length of culvert to be used. It is also claimed that their form gives them greater strength than the round structures possess, as well as facilitating easy handling and consequent saving in transportation and that they may be assembled by unskilled labor. They make good culverts for highways.

Corrugated Iron Pipe

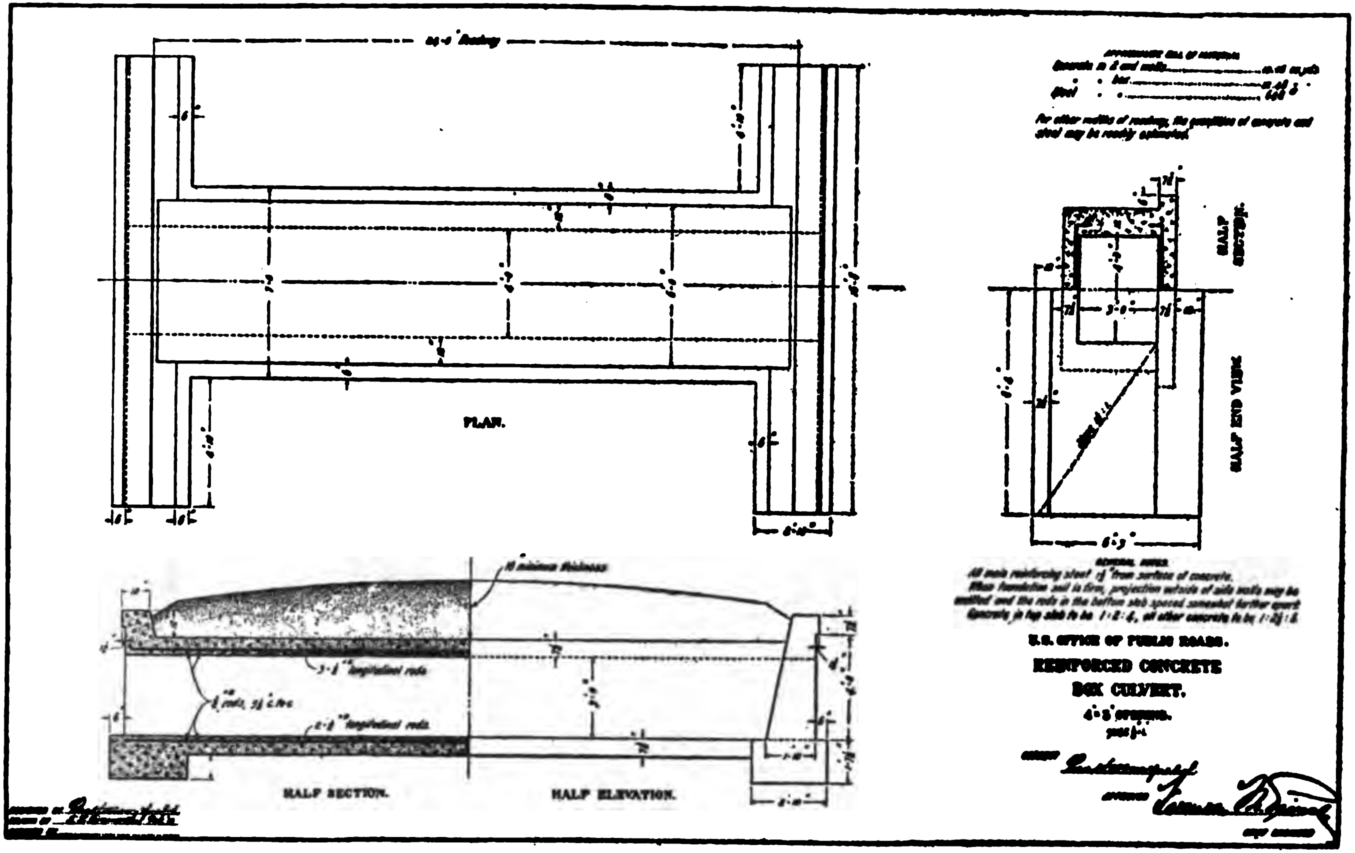
Many culverts are now being constructed of corrugated pipe made of pure iron. The corrugations make the use of relatively very thin metal possible without danger of collapse, and it is claimed that the pure iron of which the pipe is made offers superior resistance to corrosion. As far as is known, these culverts are proving generally satisfactory, but since they have been in use only a comparatively short time, their claim to durability under service conditions has not yet been fully established. It may be stated, however, that tests made on iron by the Office of Public Roads have uniformly indicated that segregated impurities present in iron affect its power to resist corrosion in a marked degree. The tests of the Office of Public Roads, in fact, formed the basis for the development of the pure iron industry (Bulletin 45, Office of Public Roads).

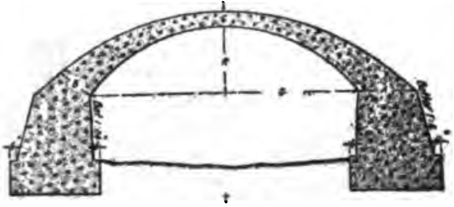
Vitrified Clay Culvert Pipe

In localities where the ground does not freeze to great depths, vitrified clay pipe has proved satisfactory as a culvert material. It should be double strength, hard burned, and salt glazed. Each pipe should be a true cylinder, free from cracks, and have a thickness of shell of at least one-twelfth of the internal diameter. In laying the culvert, care should be taken to round out the bottom of the ditch to fit the pipe, making suitable depressions for the bells. Where rock occurs in the ditch, it should be excavated some 6 inches below the lower surface of the pipe and replaced with clay or sand. In very cold climates, the pipe should be completely covered with sand or broken stone for a depth of at least 6 inches. Where earth comes directly in contact with the pipe, danger from freezing is considerably increased. The surface of the roadway should never be less than 1½ diameters above the top surface of the pipe.

Importance of Engineering Supervision

Before leaving the subject of bridges and culverts, attention should be called to the importance of having the design and construction of all such structures executed under the immediate supervision of a competent engineer. In no other feature of highway improvement can technical training be employed to better advantage. Not only the efficiency of the structure itself is involved, but human safety is not infrequently dependent on its proper design and construction.

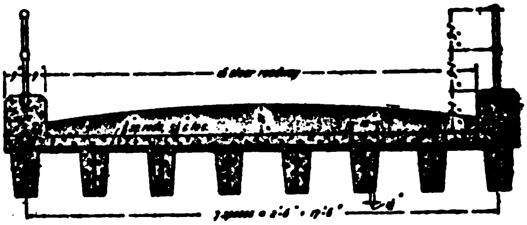

24'-0" Roadway
PLAN.
HALF SECTION.
HALF ELEVATION.
HALF END VIEW
HALF SECTION.
6'-3"
3'-0"
GENERAL NOTES.
All main reinforcing steel 1½" from surface of concrete.
When foundation soil is firm, projection outside of side walls may be omitted and the rods in the bottom slab spaced somewhat farther apart.
Concrete in top slab to be 1:2:4, all other concrete to be 1:2½:5.
U.S. OFFICE OF PUBLIC ROADS.
REINFORCED CONCRETE
BOX CULVERT.
4'-3" OPENING.



TYPICAL SECTION PLAIN CONCRETE ARCH.
Concrete in superstructure 1:2:4. In abutments and wing walls 1:2½:5.
For intermediate spans, the dimensions may be obtained by interpolation.

DIMENSIONS

Span = S	B	C	D	A
6'-0"	2'-0"	0'-8"	1'-0"	1'-0"
10'-0"	3'-0"	0'-9"	1'-11"	3'-6"
20'-0"	5'-0"	1'-1"	2'-9"	5'-3"
30'-0"	7'-6"	1'-6"	3'-9"	6'-0"

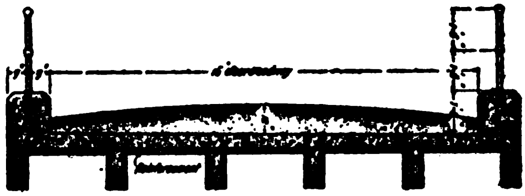


TYPICAL SECTION ENCASED I-BEAM BRIDGE.

DIMENSIONS

Span	Std. I	Span	Std. I	Span	Std. I
10'	8"-18 lb.	18'	10"-30½ lb.	26'	18"-55 lb.
12'	9"-21 lb.	20'	12"-40 lb.	28'	18"-55 lb.
14'	10"-25 lb.	22'	15"-42 lb.	30'	18"-55 lb.
16'	12"-31½ lb.	24'	15"-42 lb.		

Side channels to be the lightest standard channels of the depth specified for the I.
Concrete in superstructure to be 1:2:4.



TYPICAL SECTION REINFORCED CONCRETE T-BEAM BRIDGE.

Concrete in superstructure to be 1:2:4.

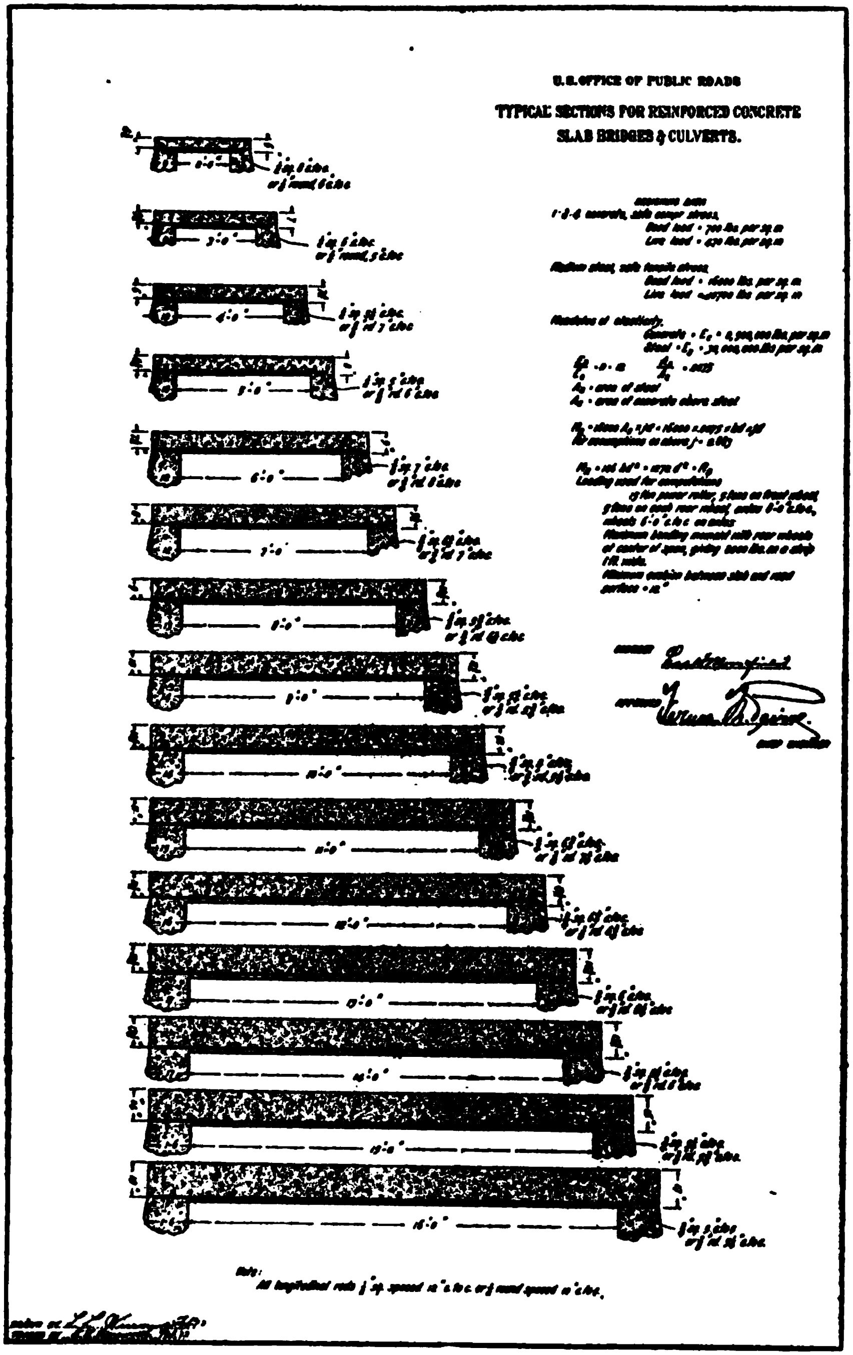
U. S. OFFICE OF PUBLIC ROADS.

TYPICAL SECTIONS FOR SHORT SPAN CONCRETE BRIDGES.

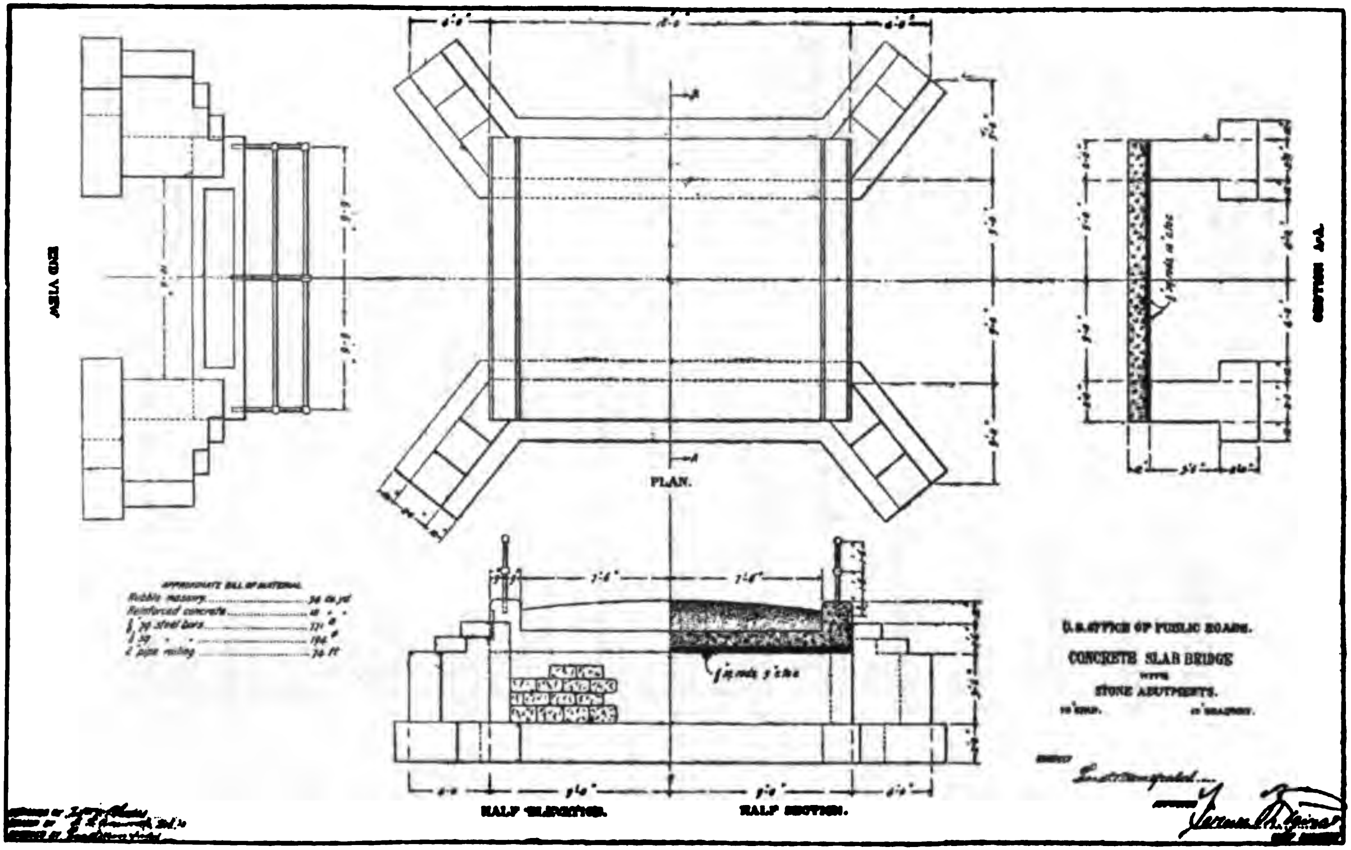
Designed Chas H Moorefield

Approved Logan W. Page
Director

Drawn by L. W.
Traced by


U.S. OFFICE OF PUBLIC ROADS

TYPICAL SECTIONS FOR REINFORCED CONCRETE SLAB BRIDGES & CULVERTS.


END VIEW
PLAN.
SECTION A-A
HALF ELEVATION.
HALF SECTION.
APPROXIMATE BILL OF MATERIAL.
Rubble masonry .... 34 cu. yd
Reinforced concrete .... 48 " "
$\frac{5}{8}$" sq. steel bars .... 771 #
$\frac{1}{2}$" sq. " " .... 194 #
2" pipe railing .... 36 ft
U.S. OFFICE OF PUBLIC ROADS.
CONCRETE SLAB BRIDGE
WITH
STONE ABUTMENTS.
16' SPAN. 18' ROADWAY.
SUBMITTED
APPROVED
Logan Waller Page
DIRECTOR
18'-0"
6'-0"
7'-6"
9'-0"
$\frac{5}{8}$" rods 9" c. to c.

MASSACHUSETTS SPECIFICATIONS FOR STATE HIGHWAYS

Specifications for Tar Grouting

Broken Stone and Bituminous Surfacing.—Section 10. Broken stone consisting of local stone shall be spread and rolled on the road bed prepared as hereinbefore described, as follows:

The width of broken stone shall be fifteen (15) feet.

The lower course shall consist of stones that will pass through a ring two and one-half (2½) inches in diameter and will not pass through a ring one and one-quarter (1¼) inches in diameter, and shall be four (4) inches deep in the centre and sides after rolling.

The lower course shall be shaped to a true section, bound with stone screenings and thoroughly rolled. Any depressions or irregularities which may occur shall be filled with smaller stones as directed by the engineer and again rolled until the surface is smooth, true, and unyielding.

The interstices in this course shall be filled to the surface and there shall be no excess of screenings remaining above the stones after a thorough rolling.

Upon the lower course of stone shall be spread the upper course of stone which shall consist of stones that will pass through a ring one and one-quarter (1¼) inches in diameter, but will not pass through a ring one half (½) inch in diameter, and shall be two (2) inches in thickness after rolling with a steam roller and evened up with material of the same size and quality as has been used in that particular course and to the satisfaction of the engineer. All broken stone shall be spread from carts by hand or from a dumping board or from self-spreading carts.

Upon the upper course of stone, prepared as hereinbefore described, refined tar shall be uniformly applied with a pressure machine at the rate of one and one-quarter (1¼) gallons to each square yard of surface, and immediately covered with clean local pea stone and then thoroughly rolled.

A second application of refined tar shall then be made in the same manner as in the first application at the rate of one-quarter (¼) gallon per square yard and immediately covered with clean local pea stone and then thoroughly rolled.

If so ordered by the engineer the thickness of the broken stone shall be increased or diminished at such points as he may direct.

No soft or disintegrated stone shall be used.

In distributing the tar no overlapping shall be allowed.

The contractor shall sprinkle the road with water when and as directed by the engineer.

All depressions in any course shall be filled with the same material used in that particular course and shall be rolled until a smooth, true and unyielding surface is obtained.

The bituminous binder shall consist of refined tar and when applied to the road surface it shall have a temperature approximating 200° F.

If at any time before the acceptance of the work any soft or imperfect places or spots develop in the surface, all such places shall be removed and replaced with new material and then rolled until thoroughly compacted, and until the joints or edges at which the new work connects with the old become invisible. All such removal and replacement of unsatisfactory surfacing shall be done at the expense of the contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are, in the opinion of the engineer, unfavorable to obtaining satisfactory results.

The Massachusetts highway commission will furnish all refined tar necessary for the work in tank cars at the railroad freight station nearest to the site of the work.

The commission will order the tar when requested so to do by the contractor.

The contractor shall be responsible for any and all railroad storage charges and for any loss or damage to material that may accrue after the delivery of the tar at the railroad delivery selected.

The contractor is to heat the tar in tank cars or otherwise, team the tar to the site of the work, and apply thereon as specified without compensation additional to the price paid per gallon for bituminous surfacing.

Double Penetration Method

Broken Stone and Bituminous Surfacing.—Section 10. Broken stone consisting of trap rock or rock which in the opinion of the engineer is equal to trap rock—local stone shall be spread and rolled on the road-bed prepared as hereinbefore described, as follows:

The width of the broken stone shall be fifteen (15) feet.

All broken stone used shall be laid in layers or courses.

The lower course shall consist of stones that will pass through a ring two and one-half (2½) inches in diameter and will not pass through a ring one and one-quarter (1¼) inches in diameter, and shall be four (4) inches deep at the centre and four (4) inches deep at the sides, after rolling.

The lower course shall be shaped to a true section, bound with sand or stone screenings and thoroughly rolled.

Any depressions or irregularities which may occur shall be filled with smaller stones, as directed by the engineer, so that the surface will be smooth, true and unyielding. The interstices in this course shall be filled to the surface, and there shall be no excess of sand or screenings remaining above the stones after a thorough rolling.

If sand is used in this course it shall be of a quality satisfactory to the engineer, and shall be measured and paid for as borrow.

The broken stone in the lower course shall be spread from the carts by hand, or from a dumping board, or from self-spreading carts.

Upon the surface prepared as hereinbefore described heavy asphaltic oil shall be uniformly applied with a pressure machine at the rate of five-eights (⅝) of a gallon to each square yard of surface.

Immediately after the application of the oil a course of stone consisting of broken trap rock in sizes varying from one-half (½) inch to one and one-quarter (1¼) inches in their longest dimensions shall be applied by spreading by hand from piles previously distributed on the side of the road, the course to be one and one-half (1½) inches in thickness after rolling.

A second application of oil shall then be made in the manner previously described and at the rate of five-eighths (⅝) of a gallon to each square yard of surface.

Immediately after this second application of oil a course of stone of the same sizes as in the first application shall be lightly spread in quantity sufficient to cover the oil, and then thoroughly rolled; after which, a third application of oil shall be made in the manner previously described at the rate of one-quarter (¼) of a gallon to each square yard of surface, immediately covered with clean trap rock pea stone, and then thoroughly rolled.

The bituminous binder shall consist of asphaltic oil and when applied to the road surface, it shall have a temperature approximating 250° F.

If so ordered by the engineer the thickness of the broken stone shall be increased or diminished at such points as he may direct.

The finished surface of the road shall present such crown as shall be directed by the engineer.

No soft or disintegrated stone shall be used.

In distributing the oil no over-lapping shall be allowed.

The contractor shall sprinkle the road with water when and as directed by the engineer.

All depressions in any course shall be filled with the same material used in that particular course and shall be rolled until a smooth, true and unyielding surface is obtained.

If at any time before the acceptance of the work any soft or imperfect places or spots develop in the surface, the material at all such points shall be removed and replaced with new material, and then rolled until thoroughly compacted, and until the joints or edges at which the new work connects with the old become invisible.

All removal and replacement of unsatisfactory material shall be done at the expense of the contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are, in the opinion of the engineer, unfavorable to obtaining satisfactory results.

The Massachusetts highway commission will furnish all asphaltic oil necessary in tank cars at the railroad freight station nearest to the site of the work.

The commission will order the oil when requested so to do by the contractor.

The contractor shall be responsible for any and all railroad storage charges and for any loss or damage to material that may accrue after the delivery of the oil at the railroad delivery selected.

The contractor is to heat the oil in tank cars or otherwise, team the oil to the site of the work, and apply thereon as specified, without compensation additional to the price paid per square yard.

Hot Oil Blanket Coat

Bituminous Wearing Course.—Section 10a. After the macadam road has been finished as herein described, the surface shall be swept with brooms, or a horse sweeper, approved by the engineer, and so as to fully expose the stones of the upper course and to remove to a slight extent the binder between them. If directed by the engineer, the road shall then be watered slightly. Upon the surface for the full width of the macadam the bituminous binder hereinafter described shall be applied in a thin film, shall be heated to the temperature hereinafter stated and distributed evenly by means of a machine approved by the engineer, so designed as to enable its operator to control the flow and to distribute the material uniformly, leaving no streaks or spots and so designed as to enable its operator to "cut out" any portion of the roadway and to avoid any surplus deposit of the binder on the roadway or elsewhere. If the engineer shall so direct the bituminous binder shall also be further distributed by means of soft brooms or "squeegees." For this portion of the work not more than one-half (½) of a gallon of said material to the square yard of surface shall be required.

As soon as may be after the application of the bituminous binder, as above specified, a thin layer of sand shall be distributed evenly thereon to such a depth that after rolling to the satisfaction of the engineer no surplus binder shall appear upon the surface of the roadway and so that there shall be a wearing course of the sand combined with the bituminous binder approximating one-half (½) inch in depth.

The completed surface of the roadway shall be smooth, conforming to the profile and cross-section, and free from hollows or depressions, and if at any time before the acceptance of the work spots or streaks appear, indicating a deficiency or a surplus of the bituminous binder, the surface shall be again treated with more of the binder or sand, as the case may be, and if directed by the engineer the surface shall be lightly watered and thoroughly rolled.

The bituminous binder shall consist of asphaltic oil, and when applied to the road it shall have a temperature approximating 250° F.

The sand used shall be clean, sharp and dry, free from loam, clay and foreign matter of all kinds. It shall contain no pebbles which will not pass through a one-half (½) inch mesh nor practically any grains or particles which will pass through a screen of thirty (30) meshes to the lineal inch.

If the contractor so desires he may use stone screenings instead of sand but it is understood that he will receive no extra compensation therefor and that the screenings must conform in general with the requirements of the specifications for sand.

The Massachusetts highway commission will furnish all asphaltic oil necessary for the work in tank cars at the railroad freight station nearest to the site of the work. The commission will order oil when requested so to do by the contractor, and the contractor hereby agrees that he will make no claim for damages of any kind which may be caused by any haste or delay in the delivery of the asphaltic oil. The contractor is to heat the oil in tank cars or otherwise, team the oil to the site of the work, and apply thereon as specified, without additional compensation.

Bituminous Macadam Surface—Mixing Method

Excavation of Broken Stone in Present Road Surface.—Section 9. The present macadam surface of the road is to be loosened with picks placed in the wheels of a steam roller or otherwise. The material so loosened is to be scarified or harrowed with a tooth harrow, so as to leave only clean broken stone on the surface, raked, shaped, and new stone added where necessary, and rolled with a steam roller to an even firm surface two (2) inches below the finished grade to the satisfaction of the engineer. Wherever it is necessary, the broken stone in the present road surface shall be screened and moved and spread on the road surface where required.

Broken Stone.—Section 10. Broken stone consisting of trap rock or rock which in the opinion of the engineer is equal to trap rock shall be spread on the road-bed prepared as hereinbefore described wherever it is necessary to give, in addition to the broken stone in the present road surface, the required width of thirty (30) feet and a depth of not less than four (4) inches in the centre and sides, after rolling. The size of the stones used in the bottom course (in addition to those in the present road surface) shall be not larger than two and one-half (2½) inches in their longest diameter and not smaller than one and one-quarter (1¼) in their shortest diameter, as the engineer shall determine.

The bottom course shall be rolled by a steam roller and evened up with material of the same size and quality as has been used in that particular course, and to the satisfaction of the engineer.

All broken stone shall be spread from the carts by hand, or from a dumping board, or from self-spreading carts.

No soft or disintegrated stone shall be used.

If so ordered by the engineer the thickness of the broken stone shall be increased or diminished at such points as he may direct.

The grade of the finished surface of the road shall present such crown as shall be directed by the engineer.

If local stone or stone not shipped by rail is used it shall be weighed on scales furnished by and at the expense of the contractor. Said scales shall be satisfactory to the engineer and they shall be sealed at the expense of the contractor as often as the engineer may deem necessary to insure their accuracy.

A sworn weigher, to be appointed and compensated by the selectmen, shall weigh all broken stone required to be weighed as above provided.

If the stone is shipped by rail the car weights may be accepted, unless the engineer shall determine that scales shall be used as above.

Bituminous Mixture.—Section 11. On the bottom course of broken stone, prepared as hereinafter specified, shall be spread according to lines and grades given by the engineer, the bituminous mixture which shall consist of trap rock broken stone mixed with asphalt; the sizes of stone, proportions of stone and of asphalt, and method of mixing and spreading to be as hereinafter described.

The bituminous mixture shall be laid in one course and shall be, after rolling, two (2) inches in thickness.

The width shall be thirty (30) feet.

The broken stone shall be trap rock and shall vary in size from one-quarter (¼) inch to one and one-quarter (1¼) inches and no stones larger than one and one-quarter (1¼) inches in their longest diameter shall be used. All broken stone used shall be absolutely clean and free from adventitious matter.

When the broken stone has been heated to not less than 180° F., or more if the engineer so required, it shall be mixed with the asphalt by machines, which shall be approved by the engineer, and as the engineer may direct, until all particles of stone are covered with asphalt.

Sixteen (16) gallons of asphalt measured at temperature of the air shall be mixed with each cubic yard of stone.

Before mixing with the stone, the asphalt shall be carefully heated to not less than 350° F. and at that temperature shall be mixed with the stone. No asphalt shall be used after it has been injured by over-heating or burning. The contractor shall heat the asphalt in suitable kettles satisfactory to the engineer.

After being properly prepared as hereinbefore specified, the mixture shall be teamed to the road and spread before it has cooled to a temperature below 100° F.

The mixture shall be dumped on steel dumping platforms or shovelled directly from the cart into place. As the spreading is done rakes shall be used to obtain a uniform distribution of stones and an even surface before rolling.

The mixture, after being satisfactorily spread and raked, shall be at once rolled with a tandem roller, weighing not less than seven (7) tons, care being taken not to push the mixture out of place by the roller, but to roll so as to lay it down, compressed to a perfect cross-section, and true to line and grade. During very hot weather the rolling shall be postponed until cool enough to roll without pushing out of place and shape.

If any unevenness or depressions appear during or after rolling the bituminous mixture, suitable mixed material satisfactory to the engineer shall be added, and rolled in a manner to remove all such unevenness or depressions.

Immediately after the bituminous mixture is rolled to a firm surface and free from irregularities, a seal coat of Bermudez road asphalt shall be so applied as to completely cover the surface, using one-third (⅓) of a gallon of asphalt per square yard of surface. It shall be carefully spread with "squeegees" or brooms.

Immediately after it has been spread it shall be covered with clean trap rock pea stone and rolled until the pea stone is bonded with the asphalt of the seal coat.

If at any time before the acceptance of the work any soft or imperfect places or spots develop in the surface, all such places shall be removed and replaced with new material and then rolled until thoroughly compacted, and until the joints or edges at which the new work connects with the old become invisible. All such removal and replacing of unsatisfactory surfacing shall be done at the expense of the contractor.

No teaming or travel of any kind shall be allowed to pass over the new surface until twenty-four hours have elapsed after the final rolling, or until the surface has become sufficiently hardened to prevent injury by picking up or tracking.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are, in the opinion of the engineer, unfavorable to obtaining perfect results.

In order to provide for passing traffic during the progress of the work it will be necessary to construct only one-half of the width of the roadway at one time. The bottom course of that portion of the roadway which shall first be laid shall be extended two (2) feet beyond the centre of the road or two (2) feet beyond the inside edge of the bituminous mixture so as to provide a firm base for the bituminous mixture, also to satisfactorily bond into the remaining portion of the bottom course when laid.

The bituminous mixture and sealing coat of that portion first laid shall lap over beyond the line of the joint at the centre of the roadway, so that when the second half is laid the first half can and shall be cut back to a uniform longitudinal line and perfect vertical section so as to obtain a perfect joint and cross-section.

From the time of commencement of laying the bituminous mixture during and until the time the final covering of pea stone is spread on the seal coat, the adjoining surface on any or all sides of the portion under construction shall be kept watered as directed by the engineer to prevent dust alighting on the bituminous surface.

The selectmen will furnish all asphalt in barrels in cars at the railroad siding requested by the contractor.

The selectmen will order the asphalt so that the first delivery of ten thousand (10,000) gallons shall be made on or about April 15 and thereafter at the rate of ten thousand (10,000) gallons a week until the entire quantity has been received.

The contractor shall be responsible for any and all railroad charges and for any loss or damage to material after the delivery of the asphalt at the railroad siding.

The contractor shall at his own expense team the asphalt to the work, store it and protect it from the weather to the satisfaction of the engineer.

Sand and Oil Road—Mixing Method

Bituminous Surface.—Section 10. Upon the road bed prepared as described in Section 9, the sand and oil surfacing shall be applied as follows:

The sand and oil shall be mixed by hand or with a mechanical mixer, or by other means furnished by the contractor, provided the method employed is approved by the engineer. If the mixing is done by hand, it shall be done on tight platforns, to be furnished by the contractor, the platforms to be made of two (2) inch plank, about sixteen (16) feet in length, and in two sections, each about four (4) feet in width.

The contractor shall furnish and operate at least four (4) mixing platforms and four (4) heating kettles or tanks, and a sufficient number of sand heaters, and if in the opinion of the engineer the work is not proceeding with sufficient rapidity to insure its completion within the time specified in the contract, the contractor shall furnish and operate a sufficient number of additional platforms, kettles, and sand heaters to insure the work being so completed within the specified time.

The contractor will be allowed to mix the hot sand and oil with a mechanical mixer or other means furnished by him, provided the method employed is approved by the engineer.

The kettles or tanks for heating the asphaltic oil shall be of a design satisfactory to the engineer, and of a capacity of not less than sixty (60) gallons each.

The sand shall be dry and so heated that when mixed with the oil a uniform mixture will be secured. Care must be taken not to overheat the sand so as to burn the oil.

The sand and oil shall be mixed in batches of approximately one (1) cubic yard, the sand being spread upon the mixing platform and the hot oil poured upon it and the whole mass thoroughly turned with shovels, hoes, or rakes, until each particle of sand is completely covered with oil, about sixteen (16) gallons of oil being required for one (1) cubic yard of sand as measured loose in measure box.

The oil when mixed with the sand shall be hot enough to secure a good mixture, and shall be of a temperature between 250° F. and 375° F., depending on nature of oil used.

When the mixture is completed to the satisfaction of the engineer it shall without delay be spread while still warm upon the subgrade to a width of sixteen (16) feet and to a depth of four (4) inches at the centre and three (3) inches at the sides, after rolling with a tandem roller weighing approximately six (6) tons.

After the mixed material is deposited in place and shaped with rakes, etc., it shall, before it hardens, be rolled with a horse roller weighing about one (1) ton, then shaped with a road machine or with a suitable scraper and afterwards rolled with a tandem roller to the satisfaction of the engineer. A hand roller weighing about two hundred (200) pounds may be used before rolling with the horse roller if preferred.

If any depressions appear after scraping and rolling the sand and oil mixture, suitable mixed material satisfactory to the engineer shall be added. If such depressions are found after the sand and oil has hardened so that the new mixture will not readily bond with the old, the old mixture shall be dug out to a depth satisfactory to the engineer and the new material added.

Any slight unevenness of the surface shall be remedied by scraping with a road machine or a suitable scraper, and the surface shall then be rolled in a manner to remove all such depressions and leave a smooth and even surface.

After the sand and oil mixture is rolled to a firm surface, free from all irregularities and all surplus loose material, a seal coat of asphaltic oil shall be distributed at the rate of one-half (½) of a gallon per square yard of road surface.

The oil so applied shall be uniformly covered with a thin layer of sand and rolled to the satisfaction of the engineer.

The asphaltic oil when applied to the road surface shall have a temperature approximating 250° F.

If so ordered by the engineer the thickness of the sand and oil mixture shall be increased or diminished at such points as he may direct.

The sand shall be clean, sharp, and dry, free from loam, clay and adventitious matter of all kinds. It shall contain no stones larger than one-half (½) inch in their longest dimensions, nor practically any grains or particles which will pass through a screen of fifty (50) meshes to the lineal inch.

The finished surface of the road shall present such crown as shall be directed by the engineer.

In distributing the oil no over-lapping shall be allowed.

The contractor shall sprinkle the road with water when and as directed by the engineer.

All depressions in any course shall be filled with the same material used in that particular course and shall be rolled until a smooth, true and unyielding surface is obtained.

If at any time before the acceptance of the work any soft or imperfect places or spots shall develop in the surface, the material at all such points shall be removed and replaced with new material, and then rolled until thoroughly compacted, and until the joints or edges at which the new work connects with the old become invisible.

All removal and replacement of unsatisfactory material shall be done at the expense of the contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are, in the opinion of the engineer, unfavorable to obtaining satisfactory results.

The Massachusetts highway commission will furnish all asphaltic oil necessary for mixing in barrels and for sealing coat in tank cars at the railroad freight station nearest to the site of the work.

The commission will order the oil when requested so to do by the contractor.

The contractor shall be responsible for any and all railroad storage charges and for any loss or damage to material that may accrue after the delivery of the oil at the railroad delivery selected.

The contractor is to heat the oil in tank cars or otherwise, team the oil to the site of the work, and apply thereon as specified, without compensation additional to the price paid per square yard for bituminous surfacing.

Shaping Surface for Sand and Oil.—Section 9. Before the sand and oil is spread the road-bed shall be shaped to a true surface conforming to the proposed cross-section of the highway and rolled by a steam roller, unless otherwise ordered by the engineer. All depressions occurring must be filled with suitable material and again rolled, until the surface is smooth and hard.

The cost of shaping and rolling the road-bed shall be included in the price paid for excavation and for furnishing the material used, and shall not be additional thereto.

When in the opinion of the engineer it is necessary to place hardening material on the subgrade of the road before the sand and oil is spread, the contractor shall spread clay or other material satisfactory to the engineer and roll the same in such manner as is satisfactory to the engineer, and with such weight of roller as he may direct.

Sand and Oil surfaces.—Section 10. Upon the road-bed prepared as described in Section 9 shall be applied asphaltic oil for a width of fifteen (15) feet, by means of a distributor, so arranged as to enable the operator to control the flow and distribute the oil equally and uniformly, leaving no spots or streaks uncovered and to avoid spreading a surplus of oil at any point, and to completely control the quantity of oil delivered on the road.

The oil shall be spread on the road at a temperature not greater than 250° F., and not less than 180° F., and shall be so heated as to insure its delivery on the road at the required temperature.

There shall be three applications of oil, the quantity for each application to be on the average not less than two-thirds (⅔) of a gallon per square yard.

After the first application of oil has been made and as soon thereafter as the engineer may direct, a layer of sand shall be uniformly spread thereon of sufficient depth to insure a thickness of approximately one (1) inch after rolling.

As soon thereafter as the engineer may determine, the second and third applications of oil and sand shall be applied in the same manner as in the first application and to the satisfaction of the engineer.

After three layers of oil and sand have been applied in the prescribed manner, the road shall be rolled by a roller of such size and weight as the engineer may determine.

During the rolling, sand shall be applied to absorb any oil which may flush to the surface and in such quantities as the engineer shall direct.

After the rolling has been completed to the satisfaction of the engineer, a thin layer of sand shall be spread evenly over the entire oiled surface.

All sand shall be clean, sharp and free from loam, clay and adventitious matter of all kinds and shall meet with the approval of the engineer.

The beginning and ending of sections of road under treatment shall be suitably barricaded and posted with warning signs as shall also all roads entering upon such sections.

If at any time before the acceptance of the work any soft or imperfect places or spots shall develop in the surface, the material at all such points shall be removed and replaced with new material and then rolled until thoroughly compacted, and until the joints or edges at which the new work connects with the old become invisible.

All removal and replacement of unsatisfactory material shall be done at the expense of the contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise, are in the opinion of the engineer, unfavorable to obtaining satisfactory results.

The contractor shall keep all of the sections of road constructed by him covered with sand to the satisfaction of the engineer for a period of sixty (60) days after the completion of the work.

HIGHWAY OFFICIALS

Office of Public Roads, United States Department of Agriculture.—Logan Waller Page, director; P. St. J. Wilson, assistant director; Vernon M. Peirce, chief engineer; J. E. Pennybacker, chief of road economics;* E. J. James, chief division of maintenance; T. Warren Allen, chief of national park and forest roads; E. B. Mc Cormick, testing engineer; C. S. Reeve, chemist; W. C. Wyatt, chief clerk.

Alabama

State Highway Commission.—Robert E. Spragins, chairman; John Craft, V. B. Atkins, Dr. Eugene A. Smith, State geologist, University of Alabama; G. N. Mitcham, professor of engineering, Alabama Polytechnic Institute; W. S. Keller, State highway engineer, Montgomery; R. P. Boyd, assistant State highway engineer.

County commissioners or boards of revenue elected by the people of each county in November of even years, have supervision over the roads. They divide the county into road precincts and appoint apportioners, who in turn appoint a road overseer for each precinct.

A county supervisor of roads to receive not more than $5 per diem, may be appointed by county commissioners, and, in acts allowing bond issues, it is usual to provide that county commissioners may appoint an engineer and fix his salary.

Alaska

Road work is under supervision of board of road commissioners of Alaska, composed of officers of the corps of engineers, U. S. A., upon whose recommendations appropriations are made by Congress.

Lieutenant-Colonel W. P. Richardson, U. S. A., president of board; Lieutenant Glen E. Edgerton, C. E., U. S. A., engineer officer, Valdez.

Arizona

Board of Control.—Geo. W. P. Hunt, governor; J. C. Callaghan, State auditor; Chas. R. Osburn, citizen member and secretary; Lamar Cobb, State engineer, Phoenix.

County Road Officials.—County board of supervisors, county road superintendents. Office county road superintendent, abolished to take effect January 1, 1915, thereafter county engineers will be appointed by board of supervisors.

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*Since March 15, 1914.

Arkansas

State Highway Commission. Five members, of which the commissioner of State lands, highways and improvements, is chairman, appoints a State highway engineer The present State highway engineer is H. R. Carter, at Little Rock.

County judges elected in September of even years, and who take office November 1, have control of highways, but there are many special laws affecting localities.

California

State Highway Commission, Sacramento.—Charles D. Blaney, Saratoga; Newell D. Darlington, Los Angeles, Chas. F. Stern, Eureka.

Austin B. Fletcher, recently of San Diego, formerly the secretary and chief executive officer of the Massachusetts highway commission, is the highway engineer and executive officer of the commission. Wilson R. Ellis of Berkeley is secretary of the commission.

County supervisors, of whom there are five in each county, elected for a term of four years in November of even years, have authority over roads. The county surveyor is elected.

Colorado

State highway commissioner Mr. T. J. Ehrhart, of Denver, Colorado. There is an advisory board of five members, composed at this time of J. M. Kuykendall, chairman, Denver; Leonard E. Curtis, V. chairman, Colorado Springs; Chas. R. McLain, member, Canon City; L. Boyd Walbridge, member, Meeker; C. E. Herr, member, Durango and secretary and engineer, J. E. Maloney, Littleton; stenographer, A. A. Ross, Denver.

County commissioners of whom there are three in each county elected by the people in November of even years for two, four and six years respectively, have jurisdiction over local roads.

General road overseer for county may be appointed by county commissioners or district overseers for districts.

Connecticut

State Highway Commissioner.—Charles J. Bennett, Hartford

Deputy Highway Commissioner.—Richard L. Saunders, Hartford

Division Engineers.—R. S. Hulbert, Winsted; E. C. Welden, Willimantic; J. A. McElroy, Bridgeport; W. H. Moody, Middletown; C. A. Campbell, Norwich; G. E. Smith, New Haven; O. W. Head, New Milford; R. W. Stevens, Hartford.

Delaware

New Castle County Levy Court.—E. B. Hollingsworth, Montchanin, term expires December 31 1916, president, for the year 1914; S. J. Burris, Wilmington, term expires December 31, 1916; C. W. Gooding, Wilmington, term expires December 31, 1914, can succeed himself for term of four years; B. A. Groves, Marshallton, term expires December 31, 1914, can succeed himself for a term of four years; M. E. Smith, Rosehill, term expires December 31, 1916; T. S. Fouracre, Middletown, term expires December 31, 1914, can succeed himself for a term of four years; W. A. Scott, Townsend, term expires December 31, 1916.

New Castle County State highway commissioner, James Wilson, who is a State official, and has charge only of the building of improved roads.

Kent County Levy Court.—W. Hart Scott, county engineer, Dover.

Sussex County.—M. T. Gum, county engineer, Georgetown.

District of Columbia

Engineer commissioner in charge of all public work, Maj. Chester Harding, U. S. A.; surface division is in charge of Captain Mark Brooke, U. S. A., assistant to the engineer commissioner; engineer of highways, Mr. C. B. Hunt.

Florida

County commissioners of whom there are five in each county, elected in November of even years, for two year terms, have supervision of roads.

Three road commissioners must be appointed annually by the county commissioners for each road district.

A road overseer must be appointed by the road commissioners for each subdivision of road districts.

Where the voters elect to have their road district a special tax road district they elect at the same time three trustees to supervise the road work of the district.

Georgia

Georgia has no State highway department but the geological survey collects and publishes data on roads. Dr. S. W. McCallie is the State Geologist.

State prison commission has authority over convict labor, which is utilized for road improvement. Mr. R. E. Davidson, Atlanta, is the chairman of the commission.

Board of county commissioners three to five members, have jurisdiction of roads and must divide county into road districts. Three road commissioners are appointed for each road district and these appoint overseers.

Idaho

State Highway Engineer.—Edw. S. Smith, Boise.

State Highway Commission as created by the 1913 legislature consists of five members: Theodore Turner, chairman; Miles Cannon; W. L. Gifford, secretary of state, secretary; F. P. King, State engineer; Dr. C. N. Little, professor of civil engineering, State University.

The three last named are made members ex-officio of the commission by the provisions of the bill creating the same. The two civilian members are appointed by the governor to hold office until the first Monday in January, 1914 and 1915, respectively, a commissioner to be appointed at the expiration of the term of each of the foregoing appointees.

Illinois

State Highway Commission, Springfield.—A. D. Gash, president; S. E. Bradt, secretary; Jas. P. Wilson. A. N. Johnson, State highway engineer and P. C. McArdle, assistant State highway engineer.

In counties having township organization three township highway commissioners elected by the people have jurisdiction, one of whom is elected in April of each year, and may employ general superintendent, overseers, et al. In counties not having township organization, county boards of commissioners, elected by the people, divide county into road districts, in each of which three highway commissioners and one clerk are elected, and these may appoint general superintendent, overseers, et al.

The new law provides also for the election of one commissioner in each township provided the voters petition for it. It also provides that in counties under township organization the supervisor becomes the treasurer of the road and bridge fund of the township; and in counties under the county commissioner system, a district clerk must be elected who should serve as treasurer of the road and bridge fund of the road district. In the latter cases, the one commissioner serves for a term of three years, after which a change may be made back to the three commissioner system in the same manner as the change was made in the first place.

County superintendents are appointed with jurisdiction over construction, repair and maintenance of all highways and bridges in counties and towns. They are by law deputies of the State highway engineer. They have veto power over expenditures in excess of $200 in all township and road districts.

Indiana

Three county commissioners in each county, one commissioner elected in November of each year, have supervision over roads. They are also ex-officio a board of directors for all free gravel, macadam and turn pike roads and shall appoint a county highway superintendent for 2 years. They also appoint superintendents of construction for gravel roads built by assessment of contiguous property.

Boards of township trustees elected in November every four years divide the township into road districts and a supervisor is elected every odd year in December in each road district.

The county highway superintendent shall appoint assistant superintendents not to exceed four for each 100 miles of road. The county highway superintendent shall have general supervision of the maintenance and repair of all county highways, bridges and culverts.

Iowa

The Iowa State College of Agriculture acts as a State highway commission.

Highway engineer, T. H. MacDonald, Ames.

County board of supervisors elected by people (three to seven members) control county work, bridge funds and portion of road funds.

Township trustees, three for each township, elected by people, control township road funds. They may appoint road superintendents. One trustee is elected each year at general election.

Kansas

The State engineer is appointed by the State Agricultural College, Manhattan.

W. S. Gearhart, Manhattan, State engineer; A. R. Losh, Assistant State Engineer.

Board of three county commissioners elected in November of odd years, has jurisdiction over State and county roads.

County engineer appointed by commissioner in June of odd years, has general charge under direction of county commissioners.

Township trustee ,clerk and treasurer constitute township highway board having charge of township roads and mail routes. Their term is two years.

One or more overseers shall be appointed by township board for each mail route and township road.

Kentucky

State commissioner of public roads, Robert C. Terrell, Frankfort.

County fiscal court, consisting of county judge and five to eight justices of the peace, elected by people, have jurisdiction over all roads. County judges elected for four years, next election 1913.

A county road engineer is appointed by said court.

A district road overseer is appointed for each road district.

Louisiana

The board of State engineers of Louisiana, of which the highway department is a branch, is composed of the following members; F. M. Kerr, chief state engineer, Gervais Lombard, J. W. Monget, Marshall Robertson, John Klorer.

The officers of the highway department of the board of State engineers, are: F. M. Kerr, chief State engineer, and president of the board of state engineers; W. E. Atkinson, State highway engineer; C. C. Sandos, secretary, New Orleans.

Police juries have control of roads in each parish. Last election April, 1912, for four years.

Maine

State Highway Commission, Augusta.—Lyman H. Nelson, chairman; Philip J. Deering; William M. Ayer; Paul D. Sargent, chief engineer.

Maryland

State Roads Commission, Baltimore.—Governor is ex officio chairman; O. E. Weller, Ira Remsen, William Bullock Clark, E. E. Goslin, W. B. Miller, Andrew Ramsay, Henry G. Shirley, chief engineer; W. L. Marcy, secretary.

Boards of county commissioners have full authority over local roads and may appoint supervisors, engineers, etc.

Massachusetts

State Highway Commission, Boston.—William D. Sohier, chairman; Frank D. Kemp, James W. Synan, Frank L. Bieler, secretary; Arthur W. Dean, chief engineer.

County commissioner may, upon petition lay out new roads or make specific improvements, and may direct towns and cities to make such improvements.

Selectmen, three to each town, elected in March each year, have purchasing power, except in cities.

A road superintendent or highway surveyor is usually elected at each annual town meeting. In some towns he is appointed by the selectmen.

Michigan

Frank F. Rogers, *State highway commissioner*, Lansing; Leroy C. Smith, deputy highway commissioner.

In counties having township system, one township commissioner, elected annually, has control.

In counties having district system control vests in a board of district supervisors, one from each township in the district, elected for a term of two years.

In counties having county system the Board of three County Commissioners is in charge. One commissioner is elected every two years, to hold office six years. All elections held the first Monday in April.

Minnesota

State Highway Commission, St. Paul.—C. M. Babcock, chairman; F. S. Bell, Clarence I. McNair. George W. Cooley, State engineer and secretary of commission; John H. Mullen, chief road deputy; Carl D. Nagel, chief Bridge deputy; S. C. Hotestein, chief clerk.

Board of five county commissioners elected in November for four year term has control of county funds subject to supervision of State highway commission. Next election 1914. Three town supervisors in each town conduct work under highway commissioners.

Mississippi

Each county must be divided into five districts, each of which elects a supervisor, the five constituting a county board of supervisors, who have full authority over roads. They are elected for a term of four years and take office in January. The next change occurs in 1916. The board of supervisors appoint three road commissioners to manage the roads of a supervisor district when the district so petitions for a term of four years, subject to supervisors control.

Missouri

Highway Department of State Board of Agriculture, Jefferson City.—Frank W. Buffum, State highway commissioner; W. S. Hawkins, deputy commissioner.

Missouri has two systems of local road administration. In ninety-two counties the county court, consisting of a chairman, elected for a term of four years, and two associates, elected for two years has control, and appoints a county engineer annually except in counties which have suspended the act relating to county engineers; divides the county into districts and appoints overseers who report to county engineer.

In the twenty-two township counties the roads in each township are under the control of a township board of three members, elected every two years, who divide the township into road districts and appoint overseers.

Next election for chairman county court, November, 1914. Two associate members county court elected November of even years. County engineers appointed in January of even years.

Montana

State Highway Commission, A. W. Mahon, Helena, State engineer, chairman; Geo. R. Metlen, secretary; Prof. R. D. Kneale, Bozeman.

County commissioners, three to each county, have supervision of roads. One commissioner is elected in November of even years and holds office for six years. The commissioners appoint supervisors and a county surveyor.

Nebraska

State engineer, Donald D. Price, Lincoln; H. W. Roberts, assistant State engineer, Lincoln.

County commissioners three to each county, elected in November of even years, have control where township organization does not exist. They divide county into districts, in each of which an overseer is elected by the people.

The county commissioners appoint a county highway commissioner in January of each year, who must be experienced road builder.

In counties under township organization, the county commissioners divide the county into seven supervisor districts, in each of which a supervisor is elected by the people. The town boards in each town have supervision over the roads, subject to the general control of the board of supervisors or the county commissioners. The town board divides the town into road districts and appoints an overseer for each district.

Nevada

State engineer, W. M. Kearney, Carson City.

County commissioners elected by the people have supervision over the roads. They appoint a county surveyor and divide the county into road districts, in each of which they appoint a road overseer.

New Hampshire

State Highway Department, Concord.—S. Percy Hooker, State superintendent of highways.

Assistant Engineers.—F. W. Brown, Concord; F. E. Everett, Elkins; W. A. Grover, Dover; H. L. Smith, Lakeport; C. M. Brooks, Keene; O. M. James, Northwood Narrows; C. H. Chandler, Concord; C. P. Riford, Concord; F. H. Colburn, Concord.

New Jersey

State Department of Public Roads, Trenton.—Edwin A. Stevens, State road commissioner; Robert A. Meeker, State highway engineer.

Division Engineers in Charge of Roads.—E. M. Vail, E. E. Reed, M. H. Weeks.

Division Engineer in Charge of Bridges.—Lloyd McEntire.

The State department of public roads is under the direct control and supervision of the commissioner.

In addition thereto a State highway commission, composed of the governor, president of the senate, speaker of the house, State treasurer and the commissioner of public roads, has charge of the design and location of a system of State highways, connecting the county seats and principal cities of the State with each other and with the main outlets to the State boundaries.

The county boards of Chosen freeholders, composed of one member from each township and minor municipality and a varying number from the several cities, are elected in November of each year. These freeholders have charge of the county roads and bridges in their several counties. They appoint a county engineer for a term of five years; they also appoint a county supervisor of roads for the same period, whose duty it is to take charge of all county repair work.

New Mexico

State Highway Commission, Santa Fe.—Wm. C. McDonald, governor; Robert P. Ervien, land commissioner; James A. French, State engineer.

The county commissioners are elected in November at the regular election day and the next election will be in 1916 and will be for a term of four years. On account of adopting a new constitution and becoming a State, the present commissioners were elected in November, 1911, and will hold for five years. The commissioners take office the first of January following election.

The county road work is under the supervision of a county road board, who are appointed by the State highway commission for term of three years and subject to removal by them for cause. This law went into effect on September 10, 1912. The various boards were not appointed until November. They have all the authority relating to roads formerly delegated to the county commissioners, except that of taxation.

New York

State commissioner of highways, John N. Carlisle; first deputy commissioner, George A. Ricker; second deputy commissioner, Paul Schultze; third deputy commissioner, Walter Willson; auditor Sephrine D. Gilbert; secretary Royal K. Fuller; Assistant secretary Frank R. Pennock, Albany.

Town highways are under town superintendents elected in November of even years. The superintendents are under supervision of a county superintendent.

North Carolina

Geological and Economic Survey, Chapel Hill.—Joseph Hyde Pratt, State geologist and engineer. Highway engineers: T. F. Hickerson, W. S. Fallis, D. T. Brown, R. P. Coble.

In most cases the county commissioners, averaging three in a county, and elected in November of even years, have control of roads. It is, however, becoming increasingly prevalent to have special road commissioners either as county or township commissions to take charge of road work.

North Dakota

State Engineer.—Jay W. Bliss, Bismarck.

Highway Commission.—Gov. L. B. Hann; C. A. Grow, Minot; Jay W. Bliss, Bismarck.

County Commissioners of whom there are three in some counties and five in others, elected by the people, may appoint a county superintendent of highways in January of even years. The county superintendent has charge of the construction and maintenance of roads, and appoints deputies.

County Superintendents.—Griggs County, Martin A. Ueland, Cooperstown; Dickey County, Sol Hunter, Oakes; Stark County, W. R. Veigel, Dickinson; Billings County, Thor G. Plomasen, Beach; McKenzie County, Chas. R. Martin, Schafer.

Ohio

State Highway Department, Columbus.—James R. Marker, State highway commissioner; deputies: Clifford Shoemaker, construction; John R. Chamberlin, bridges; A. H. Hinkle, maintenance. Division engineers: D. W. Seitz, Harwood Lersch, J. R. Burkey, Nicholas Koehler, Paul K. Sherdler, Arch. W. Smith, H. D. Bruning, J. H. Tilton, chief clerk.

County commissioners three to each county, elected in November of even years, have charge of county roads. County surveyor, elected at the same time, has direction of actual work.

Township trustees, three to a township, elected in November of odd years, have charge of township work.

Oklahoma

State Department of Highways, Oklahoma City.—Sidney Suggs, commissioner; Clark Hudson, assistant commissioner; W. R. Goit, chief engineer; Walter S. Gilbert, secretary.

Township board of trustees elected by the people has charge of roads in most of the counties. They appoint a road supervisor for each road district into which the township is divided.

County commissioners elected by the people may appoint a county engineer.

In twenty-seven counties the township was abolished as a road unit and authority was given the county.

Oregon

State Highway engineer, Henry L. Bowlby, Salem.

County judges elected by the people have charge of roads.

Township supervisors appointed every January have charge of work under direction of county judge.

Pennsylvania

State Highway Department, Harrisburg.—E. M. Bigelow, State highway commissioner; J. W. Hunter, first deputy commissioner; E. A. Jones, second deputy commissioner; S. D. Foster, chief engineer; Howard W. Fry, chief clerk.

County commissioners, three to each county, elected for four year terms have charge of county work. Township supervisors, three to each township, have charge of township work. One member is elected in February every two years and holds office six years.

Rhode Island

State board of public roads, Providence.—Robert B. Treat, William C. Peckham, John F. Richmond, Benj. F. Robinson and Abram E. Atwood, members of board; Irving W. Patterson, engineer; Peter J. Lannon, clerk.

The governor appoints one member of the board from each county for a term of five years, one vacancy occurring every year.

Each town through its officials, known as road commissioners or surveyors, looks after its road affairs. These officials are in some cases elected, in others appointed, by town council.

South Carolina

County commissioners elected in November of even years have charge of roads. In most of the counties a county supervisor of roads is elected at the same time. In other counties the commissioners appoint a county engineer.

E. J. Watson, commissioner of agriculture, commerce and industries, Columbia.

South Dakota

State Highway Commission.—E. C. Issenhuth, chairman, Redfield; N. O. Monserud, Humboldt; B. M. Wood, Rapid City.

In some of the counties the roads are under supervision of county commissioners, of whom there are five, elected by the people. In other counties township boards of three supervisors have charge of roads within the township.

Tennessee

No State highway department.

Judges of county courts have supervision of roads. In January of odd years the county court divides the county into road districts and appoints a road commissioner for each district. A board of turnpike commissioners, selected every four years by county court and consisting of three members, looks after toll roads. The district road commissioner appoints an overseer for each section of road in January each year. Many counties have special laws.

County judges have control of roads, and preside over commissioners. Court of four members besides the judge. The members are elected in November of even years for three-year terms. Districts or precincts may be formed in counties in which case trustees elected at same election have charge.

Texas

No State highway department.

The unit of administration is the county. In most instances the county judge has charge of road matters but in some counties the authority rests with a board of county commissioners.

Utah

State Highway Commission, Salt Lake City.—Wm. Spry, chairman, Richard R. Lyman, vice-chairman, W. D. Beers, secretary; Jesse D. Jewkes, Wm. Peterson; E. R. Morgan, State road engineer.

County commissioners, of whom there are three in each county, elected in November of even years, have supervision of roads. They appoint a county road commissioner who has full charge of the road work.

Vermont

State highway commissioner, Charles W. Gates, Franklin.

The State highway commissioner appoints a supervisor of roads in each county as his representative.

In March each year one selectman, of which there are three, and a road commissioner are elected in each town, the former to have charge of purchases and location and changes in roads, and the latter to have charge of maintenance.

Virginia

State Highway Commission, Richmond.—G. P. Coleman, State highway commissioner; Wm. M. Thornton, dean, engineering department, University of Virginia; Col. T. A. Jones, professor of civil engineering, Virginia Military Institute; R. B. H. Begg, dean engineering department, Virginia Polytechnic Institute; C. B. Scott, assistant commissioner; B. Atkins, clerk.

Engineers.—D. McDonald, assistant; W. F. Cocke, assistant; F. D. Henley, assistant; O. L. Grover, bridge; C. D. Snead, assistant to bridge.

County boards of supervisors, consisting of three or more members elected in January, to serve four years, have control of roads. The next election will be held in 1916. The board may appoint a county road superintendent in January of even years. They may also appoint a superintendent for each magisterial district. There are many special road laws relating to specific counties.

Washington

State Highway Board, Olympia.—Governor Ernest Lister, chairman; Wm. J. Roy, State highway commissioner, secretary; Edward Meath, State treasurer; C. W. Clausen, State auditor, and Judge M. M. Godman of the public service commission.

Three county commissioners, elected in November of even years, two every two years and one every four years, the long term alternating, have control of roads, except where township system prevails. They divide county into districts and appoint a supervisor for each to serve at their discretion.

A county engineer is elected in November of even years.

The citizens of any county may by majority vote adopt township organization.

West Virginia

State Road Bureau.—A. D. Williams, chairman and chief road engineer, Morgantown; the director of the State experiment station ex-officio and two members appointed by the governor. Personnel E. D. Sanderson, Morgantown; Geo. B. Chorpening, Clarksburg; J. W. Lynch, Union.

Three county commissioners, elected for six years, one every two years in November at regular elections, have control of roads. The county commissioners may appoint a county engineer in September of odd years.

Wisconsin

Wisconsin Highway Commission, Madison.—J. A. Hazelwood, chairman, Jefferson; W. O. Hotchkiss, State geologist, Madison (ex-officio); F. E. Turneaure, Madison (ex-officio); John S. Owen, Eau Claire; J. H. Van Doren, Birnamwood.

A. R. Hirst, State highway engineer; M. W. Torkelson, bridge engineer.

A county commissioner elected in November for three years has charge of county road work. Where State aid is obtained he must appoint a county highway commissioner to act under the State highway commission.

A town chairman of town board, elected in April each year, has charge of town roads.

Wyoming

A. J. Parshall, Cheyenne, *State engineer*; Henry G. Watson, deputy engineer, J. B. True, Asst. Engineer.

There are three county commissioners in each county, two being elected in November of the even years, one for a term of two years and one for a term of four years. These commissioners have charge of the county roads. The Counties are divided into road districts, in each of which a supervisor is elected. The supervisor performs his duties under the direction of the County Commissioners.

State Geologists

Alabama Geological Survey, Dr. Eugene A. Smith, State geologist, University, Alabama.
Arizona Geological Survey, C. F. Tolman, State geologist, Tucson, Arizona.
Arkansas Geological Survey, N. F. Drake, University of Arkansas, Fayetteville, Arkansas.
California State Mining Bureau, F. McN. Hamilton, State mineralogist, San Francisco, California.
Colorado Geological Survey, Prof. R. D. George, Boulder, Colorado.
Connecticut Geological and Natural History Survey, Prof. William North Rice, superintendent, Middletown, Connecticut.
Florida Geological Survey, Dr. E. H. Sellards, State geologist, Tallahassee, Florida.
Georgia Geological Survey, Dr. S. W. McCallie, State geologist, Atlanta, Georgia.
Illinois State Geological Survey, F. W. DeWolf, director, Urbana, Illinois.
Indiana Department of Geology and Natural Resources, Edward Barrett, State geologist, Indianapolis, Indiana.
Iowa Geological Survey, George F. Kay, State geologist, Iowa City, Iowa.
Kansas State Geological Survey, Prof. Erasmus Haworth, State geologist, University of Kansas, Lawrence, Kansas.
Kentucky Geological Survey, J. B. Hoeing, director, Frankfort, Kentucky.
Maine State Survey Commission, Mr. C. Vey Holman, State geologist, Brunswick, Maine.

Maryland Geological Survey, Prof. William B. Clark, State geologist, Johns Hopkins University, Baltimore, Md.

Michigan Geological Survey, Roland C. Allen, director, 503 Hollister Block, Lansing, Michigan.

Minnesota Geological Survey, William H. Emmons, State geologist, University of Minnesota, Minneapolis, Minnesota.

Mississippi Geological Survey, Prof. E. N. Lowe, State geologist, Jackson, Mississippi.

Missouri Bureau of Geology and Mines, Prof. H. A. Buehler, director, Rolla, Missouri.

Nebraska Geological Survey, Prof. E. H. Barbour, State geologist, University of Nebraska, Lincoln, Nebraska.

New Jersey Geological Survey, Dr. H. B. Kummel, State geologist, Trenton, New Jersey.

New Mexico, University of New Mexico, Prof. Charles T. Kirk, State geologist, Albuquerque, New Mexico.

New York State Education Department, Sciences Division, Dr. John M. Clarke, Director and State geologist, State Museum, Albany, New York.

North Carolina Geological and Economic Survey, Dr. Joseph Hyde Pratt, State geologist, Chapel Hill, North Carolina.

North Dakota Geological Survey, Dr. A. G. Leonard, State geologist, Grand Forks, North Dakota.

Ohio Geological Survey, Prof. John A. Bownocker, State geologist, Columbus, Ohio.

Oklahoma Geological Survey, C. W. Shannon, director, Norman, Oklahoma.

Oregon, H. M. Parks, State geologist State Bureau of Mines and Geology, Oregon Agricultural College, Corvallis, Oregon.

Pennsylvania Geological Survey, Prof. Richard R. Rice, State geologist, Beaver, Pennsylvania.

Rhode Island Natural Resources Survey, Prof. Charles W. Brown, superintendent, Providence, Rhode Island.

South Dakota Department of Geology, University of South Dakota. Prof. E. C. Perisho, State geologist, Vermilion, South Dakota.

Tennessee Geological Survey, Prof. A. H. Purdue, State geologist, Capitol Annex, Nashville, Tennessee.

Texas Bureau of Economic Geology and Technology, Dr. Wm. B. Phillips, director, Austin, Texas.

Utah, University of Utah, Dr. J. Fred Pack, Professor of Geology, Salt Lake City, Utah.

Vermont Geological Survey, Prof. George H. Perkins, State geologist, Burlington, Vermont.

Virginia Geological Survey, Dr. Thos. L. Watson, director, Charlottesville, Virginia.

Washington Geological Survey, Prof. Henry Landes, State geologist, University Station, Seattle, Washington.

West Virginia Geological Survey, Prof. I. C. White, State geologist, Morgantown, West Virginia.

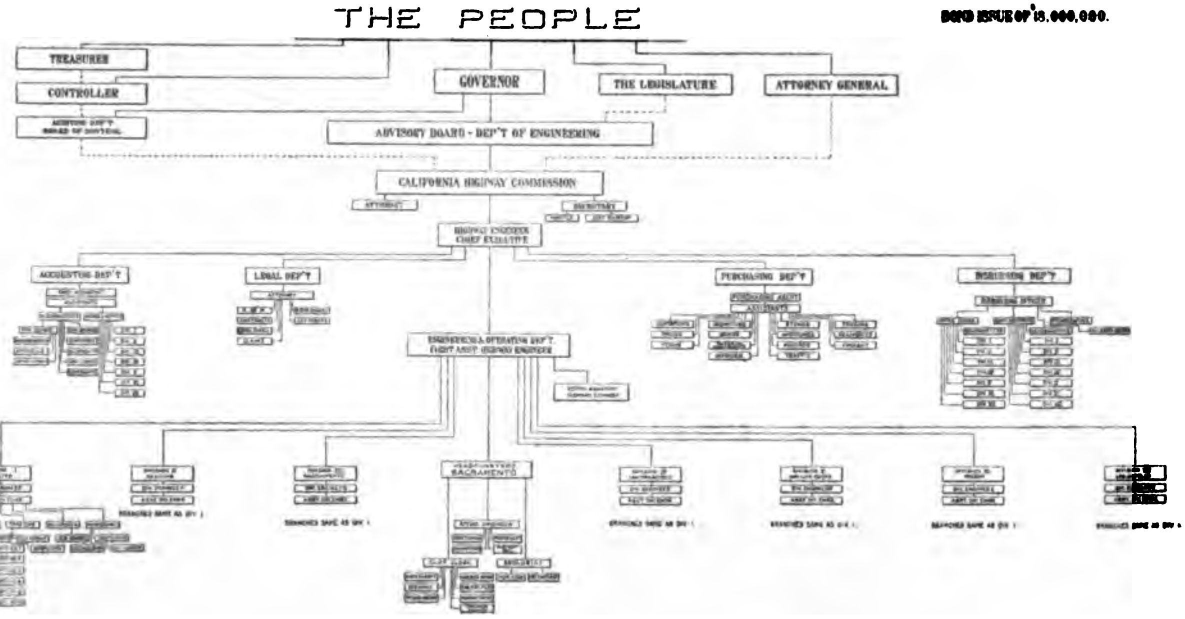
Wisconsin State Geological and Natural History Survey, Dr. E. A. Birge, director and superintendent, W. O. Hotchkiss, State geologist, Madison, Wisconsin.

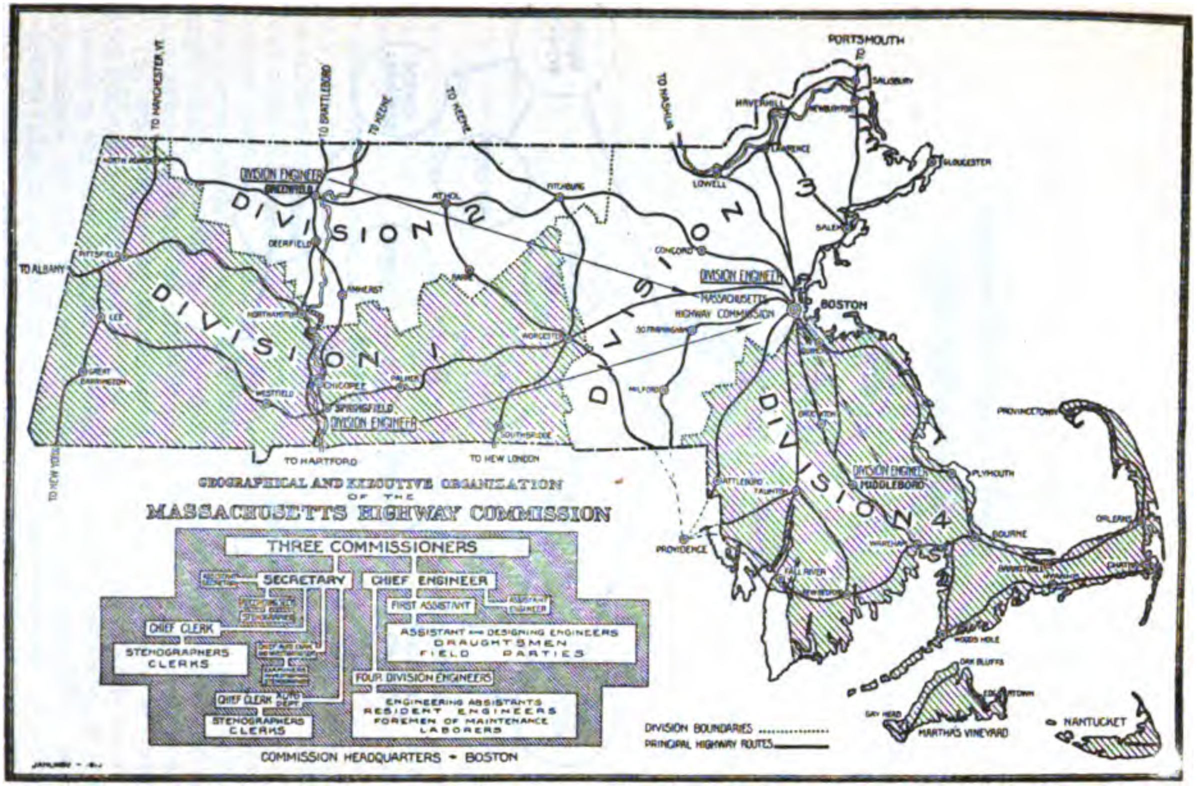
Wyoming Geological Survey, C. E. Jamieson, State geologist, Cheyenne, Wyoming.

ORGANIZATION & ACTIVITIES

CALIFORNIA STATE HIGHWAY SYSTEM

BOND ISSUE OF $18,000,000.

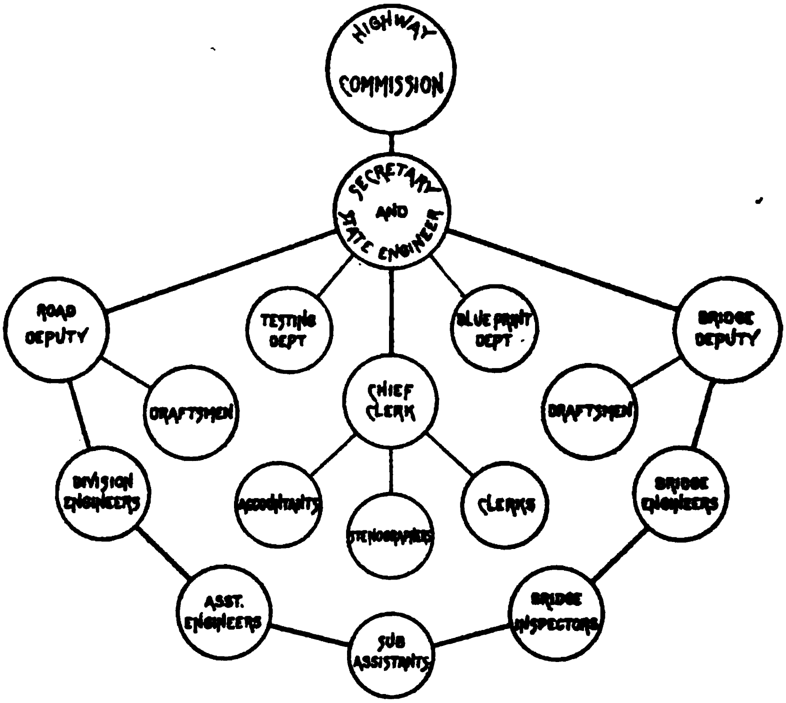




GEOGRAPHICAL AND EXECUTIVE ORGANIZATION OF THE MASSACHUSETTS HIGHWAY COMMISSION

MINNESOTA STATE HIGHWAY COMMISSION

ORGANIZATION SHEET



STATE AND U. S. PROGRESS REPORTS

United States Office of Public Roads

Since the office was established, 470 object-lesson and experimental roads have been constructed, illustrating various methods, for the purpose of instructing local road builders, stimulating sentiment for road improvement, and introducing adequate types and correct methods of road construction. The total number of square yards of road built under this project from July 1, 1905 to July 1, 1913 amounted to 4,203,640.16.

From 1902 to the present time, 7494 samples of road materials have been tested in the chemical and physical laboratories.

The office has issued 206 publications, including bulletins, circulars, farmer's bulletins and annual reports.

The photographic files of the office contain about 10,500 negatives and about 6000 lantern slides for lecture purposes.

The employes of the office on March 1, 1914 numbered 219, of which 85 are collaborators.

Among the most important projects carried on by the office at the present time may be mentioned the following:

Object-lesson roads; county model systems; advice and inspection; superintendence of county roads; road surveys; instruction of students in highway engineering; forest reserves; routine chemical testing of dust preventives and road binders; microscopic examination and classification of road-buiding rocks; research upon properties of dust preventives and road binders; standardization of methods of testing bituminous road materials; experimental bituminous road construction and maintenance; concrete investigations; non-bituminous road materials investigations; standardization of tests on non-bituminous road materials; instrument making and repairing; field experiments; traction tests; post roads; general statistical and research investigations; experimental maintenance; economic study of highway systems; traffic census; lectures and demonstration of road and bridge models; state index, including studies of road legislation and administration.

The office sends out its engineers and experts to give lectures and addresses and to confer with State and local officials on all phases of the road subject. Testing and research laboratories are maintained for the purpose of determining the suitability and relative value of the various materials for road building. A great deal of experimental work is conducted with bituminous and other binders, concrete and various special materials and methods.

In order to secure the engineering and expert advice or supervision from the office of public roads, an application should be made to the director of that office, by the local authorities having jurisdiction over the roads sought to be improved. If it is desired that road materials be tested in the laboratories of the Office of Public Roads, application should be made to the director of that office for shipping instructions, and blank forms for description of the material. The assistance given by the Office of Public Roads is free to local communities and citizens of the United States, where the object sought is of benefit to the public. The publications of the office may be obtained upon request. The office occupies the entire building at 14th and B streets S. W., Washington, D. C.

L. W. PAGE,
Director.

Alabama

(Three counties not reported)

Amount spent on roads, 1912	$1,353,750
Amount spent on bridges, 1912	290,344
Amount available for roads, 1913	1,534,424
Amount available for bridges, 1913	333,176

Number of miles of road improved during 1912

Macadam	33¼
Gravel	194
Chert	45
Sand-clay	208
Graded earth	274
Total	754¼

Number of miles of improved road in Alabama

March 1, 1912	3,780.00
Number miles improved by State aid	97.56
Number miles improved by counties	764.25
Total number miles improved in Alabama	4,641.81
Number of miles of road in Alabama	49,639.
Percentage of improved road in Alabama	9.35 per cent

The above statistics were secured from Probate Judges and County Treasurers. So few of the counties keep a separate account for construction of new roads and for maintenance, it is impossible to separate the two. No accurate account is kept as to the mileage of roads constructed; however, the reports this year are very near accurate, as we have been strict in classifying the different type roads.

Since March 1, 1913, which is the beginning of fiscal year of the highway commission, there has been constructed up to January 1st 1914 by State aid:

	Miles
Macadam	6.5
Gravel	21.5
Chert	15.0
Sand-clay	22.0
Graded earth	27.0
	92.0

There has been constructed 1950 lineal feet of steel and concrete bridges. All State aid roads are constructed according to specifications and plans furnished by the highway department and the work is supervised by a resident engineer who acts under the State highway engineer.

Each type of road is selected to suit the local conditions as far as possible and the use of local materials for surfacing is encouraged.

Rules of construction.—The width of the travel way of any State aid road must not be less than 20 feet between side ditches. The space between the improved surface part of any road and the ditches known as the shoulders, shall not be less than 4 feet each in width and the surfaced part on macadam roads shall be not less than ten feet in width. On gravel roads, the surfaced or gravelled width shall not be less than 12 feet. Sand-clay may be placed any width exceeding 14 feet, but will not be less than 14 feet. The depth of surfacing material will vary in accordance with the quality of the material and will be left to the judgment of the State highway engineer or his assistant. The grade of any State aid road shall not exceed 5 per cent. The best surfacing material near the work may be used and it must be approved by the State highway engineer or his assistant. Specifications for the construction of any State aid road or bridge shall be prepared by the State highway engineer. Where a county has a competent county engineer, he may prepare plans, profiles and specifications, but such specifications must be submitted to the State highway engineer for his approval or disapproval, or for such changes as he may deem wise.

The cost of roads vary depending on local conditions. An average cost is about as follows:

	Per mile
Macadam	$4000
Gravel	2500
Sand-clay	1500
Top soil	1200

No legislative changes have been made during the year and no changes in organization. During the year five counties have voted road bonds amounting to $680,000.

No State convicts are used on the roads and this cannot be done without a change in the constitution. Counties may work county convicts and ten counties are doing this.

Arizona

The first State road law (territorial road law) was passed in March, 1909, and carried a provision for the collection of a certain tax to raise a fund to be expended in the construction of State roads and bridges. It provided that this tax should be collected for the years 1909–10 and 1910–11. By congressional enactment, made necessary by our not having a legislative session in 1911, this tax was continued in operation for the year 1911–12. During its operation, two State highways were selected, the east and west highway, running from Yuma via Phoenix, Roosevelt, Globe and Solomonville to Clifton, and the north and south highway, running from Douglas, via Bisbee, Tombstone, Tucson, Florence, Phoenix, Prescott, Camp Verde and Flagstaff to the Grand Canyon. Upon portions of these two highways there was expended, prior to this administration, approximately the sum of $462,000. The construction work, on the east and west highway, consisted of the construction of 37 miles of road between Roosevelt and Globe; the repair and partial construction of 9 miles of road between Phoenix and Tempe and the commencement of work upon a 1500-foot reinforced concrete bridge across the Salt River at Tempe. On the north and south highway, there was constructed 23 miles of road between Douglas and Bisbee; about 10-miles through the Santa Rita Mountains between Tombstone and Tucson; 41 miles were graded between the Pima County line and Florence, and a 700-foot reinforced concrete bridge built over the Gila River at Florence. Between Phoenix and Glendale, 9 miles of road were repaired and some construction work done. On the Phoenix-Prescott road, fourteen miles were constructed south of Prescott to the top of Senator mountain and about three or four miles were partially graded south of this place. About three miles were graded on Silver mountain. Between Camp Verde and Flagstaff, eleven miles of road were constructed.

When this administration came into office on the 14th day of February, 1912, there was a deficit in the territorial road fund of approximately $25,000. All construction work had been closed down with the exception of the work on the Tempe bridge, the Florence-Tucson highway and the Black river bridge. These two latter projects were being partially financed by Pinal and Gila counties respectively. As the tax levy to create the territorial road fund had expired by limitation, there were no further funds in sight to continue the State road work. As the legislature was soon to convene, it was anticipated that it would soon enact such laws as would provide for State road construction. The grading of the Florence-Tucson highway to the Pinal county line was continued until completion in April; the Black river bridge was completed and work continued on the Tempe bridge. It was not until June 20 that the present State road law was finally passed and approved. At this time there was a deficit of over $50,000, the major portion of which had been expended on the Tempe bridge. This law provided that the funds to be raised under its provisions could not be expended until after they were collected, which meant about December of that year; it further provided that 75 per cent of the money raised should be expended in the counties in which collected under the direction of the board of supervisors and the State engineer, and the 25 per cent should be expended under the direction of the State board of control and the State engineer, wherever they might select, but that the entire deficit then existing in the State road fund, of something over $50,000, should be paid out of this 25 per cent fund. The law further provided that all the engineering expense should be paid out of the 25 per cent fund. Owing to these restrictions and provisions of the State road law, the State engineering department was confronted with the problem of making surveys and preparing plans, estimates, etc., for the expenditure of the 75 per cent fund of $187,500, with practically no money to do this work. However, the fund raised under the automobile tax law was to be converted into the 25 per cent portion of the State road tax fund. It being uncertain as to the amount that would be collected under the automobile tax, no plans could be made for its use until after collection was made. From this source about $1500 has been collected monthly since the law went into effect September 20, 1913. Owing to this shortage in funds for engineering work in the beginning and the uncertainty of the monthly collections, it was impossible to prepare for the expenditure of the county proportions of the State road fund as rapdily as they became available.

In addition to the two State highways that had been selected by the previous administration, another east and west highway has been selected running from Topoc Station on the Colorado River in Mohave County, via Kingman, Nelson, Seligman, Ash Fork, Williams, Flagstaff, Winslow, Holbrook, St. Johns and Springerville to the New Mexico line. A branch line from Tucson to Nogales was also selected as a State highway. The selection of these highways does not mean that they have been designated as such by the proper authorities and that future maintenance must be paid for out of the State road fund. Only those portions of these selected routes upon which there had been expended moneys derived from the State road law, are correctly speaking, State highways, and have to be maintained from this fund. The balance of these roads are still county roads and have to be maintained at the expense of the county from their county road funds. It is necessary to limit the State roads to be maintained from the State road fund to those portions that have been constructed out of the State road appropriation, otherwise we would have, with the three State roads mentioned, a total mileage of about 1,600 miles with about $275,000 to construct and maintain them, or approximately $170 a mile.

LAMAR COBB,
State Engineer.

Arkansas

No progress report received as the State highway department was only established in 1913 and sufficient time had not elapsed for the department to compile data.

California

The State has undertaken to construct and maintain a system of State highways distinct from the State roads built under legislative appropriation, and has appropriated the sum of $18,000,000 for the purpose.

The State highways act outlines in somewhat general terms the scope of the work, the locations of the routes, places the jurisdiction over the proposed State highways in the department of engineering and provides for a bond issue of $18,000,000 and for a State highway fund and a State highway sinking fund. This act was approved by the people at the general election held in November, 1910.

The commission has organized its work after the fashion of a modern business corporation. The commissioners act as a board of directors. Reporting directly to the commission are its secretary, the highway engineer, and the attorney. The highway engineer was made the executive officer of the commission corresponding to the general manager of a business corporation. Under him are the several departments of the work: Engineering and operating department, legal department (in right of way matters), purchasing department, accounting department, disbursing department.

The chiefs of the several departments report directly to the highway engineer.

Beginning with May 21, 1912, the advisory board of the department of engineering, have adopted sections of State highway aggregating 429.1 miles in length. Contracts for the construction of State highways have been authorized aggregating about 356 miles estimated to cost about $2,900,000.

State highway bonds had been sold previous to and including December 31, 1913, to the amount of $5,200,000.

The commission has expended for preliminary expenses, surveys, overhead expenses and for road contracts to and including December 15, 1913, the total sum of $2,588,000.

A. B. FLETCHER,
Highway Engineer.

Colorado

The total length of roads in the State is estimated to be 30,000 miles, of which 350 miles are estimated to be hard surfaced. No roads have been completed entirely at the expense of the State, but it is estimated that 5000 miles have been improved partly at the expense of the State and partly at the expense of local subdivisions an additional 600 miles are in course of improvement jointly by the State and subdivisions. No roads are maintained at the expense of the State but there are approximately 5300 miles maintained under the direction of the county commissioners for which the State pays a portion of the cost. There were 1600 miles of road graded and drained and about 50 miles of road surfaced with gravel, shale and clay, under the direction of the State highway commission during the calendar year 1913. The total expenditure of State funds on State roads during 1913 was $447,400.08, and of county funds on these roads $343,600 making a total expenditure on State road system for the year of $791,008.

The last legislature amended the highway act by providing for one State highway commissioner and an advisory board of five members, who were appointed and took office in March, 1913. The State highway commissioner receives a salary of $3,000 and the secretary-engineer a salary of $2,100. No bonds were issued in the State during the year but the direct tax has been increased in most of the counties.

Five convict camps of approximately 50 men each were worked on the roads in differenct portions of the State during the year.

The grading and ditching on the 1600 miles of State road during 1913 averaged about $350 per mile. About 180 bridges were built, mostly of steel and reinforced concrete, at an average cost of $800 each; 900 culverts were placed at an average cost of about $30 each. The 50 miles of road surfaced with gravel, shale and clay averaged about $1200 per mile. The expenditure on county roads of the State amounted to about $100,000 on some 20,000 miles of road. Work has been in progress in every county in the State and the main passes have been rendered so as to permit travel with comfort, and by the end of the coming season it will be possible to travel by wagon or automobile to any section of the State.

J. E. MALONEY,
Secretary-Engineer.

Connecticut

At this time it is not possible to furnish the information desired.

The department did a large amount of work last year and has been awarding contracts practically twice a month ever since the first of October.

C. G. Nichols,
Chief Clerk.

Delaware

The good roads work in this State was first taken up under an act of the general assembly approved April 14, 1903, which provided for the appointment of a commission of three, one from each county in the State, which had charge of all improved roads to be built in the State under State aid.

The act provided that the State would pay one-half the cost of building roads in each of the three counties if the cost per year to the State did not exceed $10,000 for each county. The act also required that public meetings be held for the promotion of the good roads sentiment.

The commissioners appointed under this act were Cornelius J. Horrigan, chairman; Walter J. Harrington, secretary, and John Barr.

Under this law there were built 7.98 miles in New Castle County, and 0.907 miles in Sussex County.

The above mentioned law was repealed at the session of the General Assembly held in 1905 and the law under which we are now working in New Castle County was approved March 3, 1905. This law created the office of New Castle County State highway commissioner, applied to New Castle County only, and provided for State aid to the extent of $10,000 per year. The highway commissioner however has charge of the building of all improved roads in the county, whether State money is used or not and all plans, specifications and contracts must be approved by him before they become effective and no bills can be paid without his approval; in other words the highway commissioner and the levy court are both responsible for the proper building of the roads and the payment of all bills relating thereto. The highway commissioner has no jurisdiction over the roads after they are finally accepted from the contractor.

Under this law there have been built 155.47 miles, all of which is water bound macadam, with the exception of about 3.13 miles of a bituminous surface, penetration method, and 0.94 miles of amiesite road. The county has also taken over 11.32 miles of turnpikes, making a total of 166.79 miles of stone roads under its care. This year $50,000 was set aside from our taxes for the maintenance of these roads, and two more steam rollers with their accompanying sprinklers were bought, making five rollers, with their water barrels sprinklers, etc., in the seven rural districts. Within the next year we shall have completed some 15 miles more of improved roads making over 180 miles of improved road. A bond issue of $100,000 was specially set aside to fill in the gaps or broken pieces of road, so as to make at least one continuous improved road from the northern boundry of New Castle County, or Pennsylvania line, to the southern boundary, or Kent County line. Only 4 miles remain to complete this road, which are now under contract and will be finished early in spring. We have now eight good stone roads, radiating from Wilmington to the Pennsylvania State line and have hopes that in the near future that State will meet us at some of them. We have also built two to the Maryland State line on routes to Baltimore. Maryland has met us on the old Newark and Elkton road with a very good improved highway. In our efforts to find some good surface treatment, both durable and economical, we have experimented with several kinds of oils, calcium chloride and a small quantity of glutrin, but as yet are undecided in the matter. Kent and Sussex counties have no State highway commissioners, but have a road engineer in each, appointed by their respective county bodies, and I understand are beginning some good work.

The expenditures on construction of roads has been about $1,250,349.45 making an average cost of construction of about $8,500 per mile. This cost includes the construction of bridges, culverts (mostly concrete) and all other appurtenances necessary in the proper construction of a good road.

The estimated length of all public roads in this county is about 1000 miles, from which it may be seen that nearly 18 per cent of our roads are improved roads.

The commissioner appointed under the act of March 3, 1905, was Francis A. Price, who held the office until January 7, 1913, when he was succeeded by James Wilson, the county engineer of New Castle County, thus combining the two offices in one person.

The General Assembly of this year 1913, passed a law empowering the levy court to contract, when advisable, without county workhouse authorities for the use of the short term prisoners on our county roads. With this law we have done considerable repair work, and built one short stretch of road 625/1000 miles in length at a contract price of $2493. The work so far has been very satisfactory.

JAMES WILSON,
County Engineer.

District of Columbia

The commissioners forward to congress, through the secretary of treasury, estimates of proposed expenditures for each fiscal year ending June 30. To the extent to which these estimates are approved, inasmuch as the national government owns fully one half in value of the property in the district, congress appropriates 50 per cent, and a like proportion is paid from the district revenues.

Pavements	1912 miles	1913 miles
Asphalt	146.93	148.27
Asphalt block	33.02	33.37
Granite block	25.96	25.96
Cobble	3.84	3.75
Vitrified Block	1.40	1.40
Bituminous Concrete	1.75	2.13
Cement Concrete	0.54	0.91
Bituminous macadam	4.94	4.94
Waterbound macadam	92.10	94.80
Gravel and dirt roads	160.00	160.00

Approved by MARK BROOKE,
Captain, Corps of Engineers, U. S. A.
Assistant to Engineer Commissioner, D. C.

Florida

As there is no State highway department it is impracticable at this time to obtain a comprehensive report on road improvement throughout the State.

Georgia

No State highway department exists and a State report is therefore impracticable. It may be stated, however, that upwards of 5000 State convicts are regularly employed on the public roads of the State under local supervision, resulting in a great increase in the mileage of improved roads, particularly of the sand-clay type.

Idaho

It is estimated that the length of main traveled roads in the State is 5000 miles, of which 38 miles is improved by hard surface and 25 miles by sand-clay surface. No roads have been completed at whole or partial expense of the State but at the close of 1913 there were 4 miles under construction for which the State pays one-third of the cost. The State does not maintain any of the roads nor contribute any part of the cost of the maintenance. No convict labor is yet employed on roads. The present State highway department was created by the 1913 legislature and consists of a State highway commission of five members including ex-officio, the State engineer, secretary of State, and the professor of civil engineering of the State University, and two civilian members appointed by the governor. The engineering department is under the direction of a State highway engineer appointed by the commission. The legislature authorized a State bond issue of $200,000 to aid in the construction of proposed State roads on the plan of the State bearing one-third of the cost of construction and the county two-thirds. The location, surveys, estimates etc., are made at the expense of the State and the roads are built under the supervision of the State highway engineer under contracts which are let by the State highway commission. After completion all roads of this kind are maintained at the expense of the State.

Bonds voted to January 1, 1914, as follows: Ada $234,484; Bear Lake $45,000; Boise $70,000; Canyon $198,782; Custer $15,000; Fremont District No. 1 $120,000; Gooding $160,000; Kootenai $83,071; Lincoln Highway District $130,000; Oneida Highway Districts $59,000; Twin Falls $100,000; and Washington $6,500; or a total of $1,221,837. With these funds the roads have been constructed or will be constructed as follows: sand-clay 585 miles, gravel 65 miles, macadam 7 miles, total 657 miles. Of the bonds voted in Canyon County, $151,162 was for bridges, and of the bonds voted in Twin Falls $50,000 was for bridges, making a total of $201,162 for bridges, thus leaving the net total for roads $1,020,675.

Ed. S. Smith,
State Highway Engineer.

Illinois

Construction on the basis of 12 feet wide

	Miles
Experimental macadam road built	35.80
Non-experimental road built with State stone, about	60.00
Bituminous macadam road built under State supervision	0.87
Concrete road built under State supervision	7.56
Resurfaced bituminous macadam and waterbound macadam	9.00
Total road built	113.23

Cost

Cost of experimental macadam built under State supervision	$130,751.11
Cost of concrete roads	72,782.14
Cost of bituminous macadam and repairs under State supervision	7,616.97
Cost of non-experimental roads built with State stone, estimated at	240,000.00
Total cost of work excluding engineering, inspection and depreciation on road equipment	$451,150.22

Bridges

123 concrete, and 18 steel bridges	$200,000.00

A. N. Johnson,
State Highway Engineer.

Indiana

No State highway department exists and no central source of information from which a comprehensive report could be obtained.

Iowa

The estimated total mileage of all the roads in this State is 102,000. The estimated total mileage of roads improved by hard surfacing is 500. Included under this heading would be classified all roads that have been macadamized and have concrete or brick surfacing. At this time there are, to our knowledge, only 2 or 3 miles of concrete roads in this State outside the limits of incorporated cities and towns. The estimated amount of 500 miles does not include a large percentage of the roads in the State which have been graveled. This can hardly be called hard surfacing and for this reason has been omitted from this classification.

There is no law in this State which allows the State to bear a portion of the expense for the construction and maintenance of the highways. At present this work is carried on entirely by the townships and the counties. Under the law enacted by the thirty-fifth general assembly of this State, all of the roads in the State are under the general supervision of the state highway commission. A division is made in each county into township and county roads. The county constructs and maintains the entire county road system which is composed of not less than 10 per cent and not more than 15 per cent of the total mileage of the county. These roads included in the county system have been designated as county roads and the township officials have no authority over them. The remainder of the roads in the townships outside of the limits of incorporated cities and towns are under the supervision of the local township officials namely, the township trustees and road superintendents.

The thirty-fifth general assembly provided a maintenance fund consisting of 8 per cent of the motor vehicle tax for the general expenses |of the state highway commission. This is the only expenditure made by the State towards road improvement at this time. Previous to April 9th, the date when the new law went into effect, the work of the commission was carried on as a department of the State College under an appropriation of $10,000 per year. This year the estimated amount available for the use of the commission is $54,000.

A very radical change was made whereby the board of supervisors of each county was required to appoint a county engineer who has general charge of the road and bridge work throughout the county. Under the present law all of the bridges regardless of size or location excepting those inside the cities and towns, are built and maintained by the county board of supervisors under plans and specifications issued by the commission.

During the past year a number of important changes have occurred in the organization of the commission. At present the commission is composed of three members, namely, A. Marston, chairman, J. W. Holden, and H. C. Beard, and a highway engineer, Thos. H. MacDonald. The detailed work of the commission is carried on in four departments, the designing department, educational, field, and office department. The State has been divided into five sections over which is placed a district engineer under the direct charge of the field department. At present the commission force consists of about thirty employes.

We are unable to supply you with information regarding financial progress, bond issues, etc., in this State. We have asked for a report from the county engineers which will give this information accurately. We will have these reports filed and financial statements issued as soon as possible. There was very little actual work of convicts on the roads in this State, although the experiment was tried by the State Reformatory of Anamosa, Ia. where a number of convicts were taken to the State College and used there on construction work. They were paid regular wages and were not kept under guard. The plan has worked very successfully and with one exception no attempt was made to break their parole.

The commission is at present conducting a series of lectures in each of the counties of the state on road work. We are also issuing a monthly publication entitled a "Service Bulletin." This bulletin is being sent to all the road officials in the State as well as others interested in road work. This bulletin will contain the current news relative to important road projects and general information of interest to road workers. This bulletin will also contain current quotations and prices on road and bridge material, and all information and data concerning contract lettings, etc.

During the past year the commission has prepared special plans and designs for over $1,000,000 worth of bridge and culvert work. Standard plans have been issued for a number of the general types of highway bridges used in the State as well as standard cross sections for the road work. At present there is a great deal of interest being taken in the betterment of the highways in the State. The commission is endeavoring in every way possible to impress upon the road officials the necessity of maintaining the entire mileage of the highways in the State in a safe condition. A very marked improvement has been made in the past year in the condition of the roads and bridges.

During the past ten months under the new law, a great improvement in the amount and character of road and bridge work has been apparent. During 1914, about $10,000,000.00 will be available for expenditure from county, township, and motor vehicle tax. Eighty-five per cent of the automobile tax is returned to counties for use in permanent road work. Eight per cent is set aside for support of the highway commission. In 1913 this amounted to about $60,000.

A one mill non-divertible drag tax producing nearly $1,000,000 annually must be levied by the townships for dragging purposes only. As a result of winter road dragging Iowa roads have been in use by automobiles all through the past winter.

THOS. H. MACDONALD,
Highway Engineer.

Kansas

The board of regents of the Agricultural College appointed a highway engineer in 1909 and provided funds to support the office from the appropriations for the department of college extension. In 1911 the legislature authorized the board of regents of the Agricultural College to appoint a State engineer of highways and bridges, and authorized him to furnish advice and scientific knowledge concerning plans and specifications for road and bridge work free of charge to highway officials when they requested the same.

The salaries and expenses of the State engineer and his assistants are provided for from the appropriation for the department of college extension. The amount of funds available for the year ending July 1, 1914, is $9150, and for the year 1915 about $10,300.

During the past year plans, specifications and estimates have been furnished on about $298,900 worth of bridge work, about $107,000 worth of road work and about $225,000 worth of drainage and irrigation work. In our educational campaign speakers have been furnished for 210 meetings. This includes the superintending of the work of six good road days.

W. S. GEARHART,
State Engineer.

Kentucky

The State department of public roads was organized July 1, 1912. The State appropriates $25,000 annually for the support of the department.

The department furnishes plans, specifications and estimates for all bridges over $500 in value. It furnishes surveys, specifications and estimates for all new roads and the same for all reconstruction when requested by the fiscal courts. The department also keeps up a continuous campaign along educational lines by mailing bulletins for road information by displaying road models at the State fair and some of the larger county fairs, by holding road meetings over the State and by furnishing speakers for road meetings in the various counties of the State. Since the organization of the department plans, specifications and estimates for about 200 bridges have been made, surveys for about 75 miles of new road have been made, about 400 miles of old road has been inspected and advice furnished. In some cases the department has furnished superintendents in actual construction and reconstruction of roads. In the November election of 1913 an amendment to change the constitution of the State to allow convict labor on public roads was voted upon and carried. The Legislature convenes on January 6th, 1914 and it is expected that this body will make some changes in the existing road laws of the State.

ROBERT C. TERRELL,
State Commissioner of Public Roads.

Louisiana

During the year 1913, the highway department, board of State engineers, extended State aid to seven parishes for the construction of ten highway projects aggregating 103.8 miles, of which 30 miles are graveled roads and 73.8 miles improved earth and sand-clay. The estimated cost of construction is $297,000 the State contributing approximately $111,000 and the parishes the remainder.

State convicts were not employed during 1913 in the construction of State aid projects.

Concerning the expenditures made for highway construction in Louisiana undertaken by various authorities independently of the highway department, will state that no figures were compiled covering these expenditures for 1913, but a conservative estimate based on the information on hand would indicate the following:

Parish expenditures	$2,600,000
Municipal	1,500,000
Contracts let by highway department	297,000
Total	$4,397,000

The highway department, board of State engineers, will have available during 1914, approximately $130,000 for distribution among the parishes applying for State aid. Figuring from present indications, this department will construct and have under construction during 1914, State aid highway projects costing about $500,000.

Bonds are being issued and special taxes voted in many parishes of this State and there is no question but that highway construction is becoming a real live issue in Louisiana.

C. C. SANDOZ,
Secretary.

Maine

Lineal feet and cost of road work done under supervision of highway department, 1913

	Feet	Cost
Gravel	685,042	$426,497.12
Earth	54,855	31,490.78
Macadam	25,288	36,086.18
Bituminous macadam	32,114	58,709.61
Concrete	62,571	189,311.25
Wood block	523	7,722.01
Sand clay	1,664	859.49
	862,057	$750,676.44

Maintenance in which costs were separated

	Feet	Cost
Marion and Edmunds	13,200	$1,960.62
Indian Township	23,010	3,339.01
Rockland and Rockport T. L.	15,840	2,454.25
Lily Bay Township Sp. Res	18,480	453.48
	70,530	$8,207.36

Cost of culverts included in the above $50,004.99. 135,911.05 feet of "V" drain cost not separated

Culverts not included in above, also bridge, $5,482.70.

In the 1913 auto work 66,960 feet received repairs or maintenance not included in the above table, but costs were not separated and are consequently included.

Cost of bridges under special appropriations, $49,669.79.

P. L. Hardison,
Assistant Engineer.

Maryland

The State roads commission of six members consisting of the governor, ex-officio, and five members to be selected by him, was established in 1908 and State bonds were authorized to the amount of $5,000,000 for the purpose of building a main arterial system of State roads connecting Baltimore city with the counties and the county seats with each other as far as practicable. On April 1, 1909 the State road system was finally adopted to include 1,285 miles. On June 1, 1910, the State aid work and the construction of the Washington boulevard were transferred from the Maryland geological and economical survey to the commission, and the assembly provided an additional $1,000,000 in bonds. During the year 1908, 1909, 1910 and 1911, a total of 353.44 miles of new state road were let or otherwise arranged for by the commission at a cost of $4,037,217.16.

On January 10, 1912, Governor Goldsborough was inaugurated and became an ex-officio member of the commission. On April

8, 1912, the assembly authorized another issue of $3,170,000 of State bonds. In May, 1912, Henry G. Shirley succeeded W. W. Crosby as Chief Engineer and several changes were made in the membership of the commission. On June 1, after a thorough study of various systems, a modern system of bookkeeping and accounting was installed by the commission and on June 10 the executive and engineering offices were combined thus affecting a saving in expense. On August 15 the construction and maintenance departments were consolidated and the State was divided into eight geographical sections with a resident engineer living at a central point of each residency, responsible for all construction and maintenance for both State and State aid work in his territory and equipped with a motor cycle so as to enable him to reach all parts of his section quickly. This change resulted in a saving of many thousand dollars as well as in greatly increased effectiveness. On August 20 a purchasing department was organized for the purchase of all supplies and equipment, this department saved the State about $25,000 in sixteen months. In October the taking of cash discount on bills was commenced by which $3,300 was saved in fourteen months. The engineering and inside forces are assembled at headquarters several times each year for discussion and this plan has been found to work well. The engineering department has been classified and placed upon a merit basis.

Active operations in 1912 were not begun until July on account of the reorganization work but during the year 96.16 miles of new State road were begun at an approximated cost of $906,672.55. In maintenance work 182.4 miles were oiled and 4.65 miles resurfaced or reconstructed. On State aid work 6.92 miles of new road were let at an estimated cost of $77,776.36, 8 miles were certified to the comptroller, surveys made on 83.97 miles, plans prepared on 16.5 miles and 8 miles accepted. The total approximated amount of State and State aid work in 1912 was $1,529,501.25 (exclusive of $175,000 paid by counties), covering 307.78 miles of road.

A system of monthly reports was inaugurated in 1913, specifications were simplified, checks and safe guards for payments and estimates provided. On the State system 154.46 miles of new road were begun at a cost of $1,700,937.35; 202.42 miles were completed; 90.98 miles were under construction at the end of the year; surveys were made of 372.03 miles; plans were prepared on 235.79 miles. In the maintenance work 326.61 miles were oiled; 575 miles were maintained and a total of $261,379.48 expended for oiling and maintenance. On State aid work, 54.88 miles of new road were started at a cost of $595,718; 18.15 miles were certified to the comptroller surveys made of 94.83 miles; plans prepared on 69.68 miles; and 18.15 miles accepted. A total of 366.55 miles of State and State aid work in 1913 approximated $2,363,905.39.

The net proceeds of the $9,170,000 of State bonds amounted to $8,864,775.02. This discount was due to the fact that $5,000,000 of bonds carried only 3½ per cent interest and $4,710,000 carried only 4 per cent interest.

It is estimated that it will require an additional $9,000,000 to complete the 1285 mile State road system. The commission estimates that it can economically expend $6,000,000 in 1914 and 1915 on the State system. The commission recommends that $500,000 from the Annapolis boulevard fund be applied to the State road system leaving $5,500,000 which it recommends be provided by State bonds for 1914 and 1915.

Summarizing the construction the commission shows that 45.96 miles were completed in 1910; 86.51 miles in 1911; 153.92 miles in 1912, and 202.54 miles in 1913; making a total of 489.93 miles. The average cost of the roads constructed in 1910 was $10,481.19; per mile in 1911 $12,296.43; in 1912 $10,833.82; in 1913 $8,286.45, or a general average of $9,986.92. The overhead expense per mile averaged $1,213.13 for the years 1908–1911 inclusive; $380.95 for 1912 and $309.63 for 1913.

The patrol system of maintenance was in effect on 575 miles in 1913 employing 170 patrolmen. The average length of road maintained per patrolman was 5.37 miles. The average cost of oiling roads in 1913 was $346.59 per mile. The average cost of total maintenance per mile in 1913 was $434. The net receipts from motor vehicle fees in 1913 were $263,845.91 of which $132,494.04 was applied to maintenance of State roads and $78,582.69 to maintenance of State aid roads. The legislature of 1912 provided a one cent direct tax for maintenance, which yielded only $30,996.68 in 1913 but it is estimated that this tax will yield from $90,000 to $100,000 per annum for 1914 and 1915.

Massachusetts

We laid out about 60 miles of State highway during the year, and completed work in over 49 miles that we laid out in 1912.

Besides $1,000,000 we had some $630,000 available under special acts for particular roads.

The commissioners have constructed, under the "small town" act, over three hundred fifty-three miles, and with money available from the motor-vehicle fees for use in towns, nearly one hundred thirty miles of road have been constructed and improved, and from special appropriations, over twenty-eight miles.

We had available for maintenance and construction $1,000,000 for State highways and small town roads. There was appropriated $200,000 from the State tax for the maintenance of State highways, and $513,000 was available from net motor vehicle fees, making a total of $713,000 available for the maintenance of State highways. There was $138,000 available for through roads in the towns from the motor vehicle fees. The municipalities contributed $212,000 in connection with this work.

The commission has been doing work in 222 cities and towns under the "small town" act, State highway, motor vehicle fees, etc., out of 354 in the State.

Of State highway, over 22 miles were bituminous macadam; 9 miles water-bound, which will be covered with butiminous binder; 4 miles gravel; 4¾ miles sand and asphaltic oil; 3¼ miles macadam covered with a heavy asphaltic oil; 2 miles of concrete; 3 miles of bituminous gravel, and ½ mile of granite block on a concrete basis.

It has been continuing to fill in the gaps on the through roads as rapidly as possible, and almost all the cities and towns have coöperated so that a number of the main through lines will soon be completed. The town of Athol, alone, appropriated $54,000 to build the two miles of road through the village which are on the route from Boston to Greenfield, or Keene, N. H.

During the year we used bituminous materials on over 500 miles of State highway, and resurfaced thirty-three miles of the older roads. Out of our total of 980 miles of State highway, 881 have now been treated with some form of bituminous material, either in resurfacing or on the surface.

The most noticeable thing in Massachusetts is the interest that has been aroused in almost every single town in the State, in good roads. More and more towns are asking for engineering advice, and more and more towns are making appropriations to be used in connection with the allotments to be made by the commission in improving the main roads in the towns.

The fact that we actually did work and made appropriations in over two-thirds of all the towns and cities in the commonwealth shows how the good road movement has grown in the state.

WM. D. SOHIER,
Chairman, State Highway Commission.

Michigan

The total length of road in the State is estimated to be 70,000 miles, of which it is estimated that approximately 3,700 miles are hard surfaced. No roads have been built entirely at the expense of the State but there are 11 miles under construction at the expense of the State by special appropriations, the total length of roads constructed partly at the expense of the State and partly at the expense of the local subdivision, is 1700 miles and it is estimated that about 500 miles are under construction at joint expense of State and local subdivisions. No roads are maintained entirely at the expense of the State but the entire 1700 miles of State road are maintained by townships and counties under the supervision of State highway department. During the calendar year 1913, 524 miles of roads were completed under the supervision of the State highway department. The total expenditure of State funds during 1913 under the direction of State highway department, was $250,000. New legislation was enacted providing for a trunk line system as explained in a chapter on State aid legislation.

LEROY C. SMITH,
Deputy State Highway Commissioner.

Minnesota

No progress report received from the State highway department in time for publication.

Mississippi

An estimate has been made by the officials of each county showing the mileage of all the roads in the State to be as follows:

Total mileage of public roads 44,803; mileage improved as follows: macadam 100, gravel 487.81, sand clay 920.16, other hard surface 100, making a total of 1607.97 miles. Approximate mileage under construction as follows: macadam 15, gravel 330, sand clay 465, other hard surface 50, making a total of 860 miles.

The recent bond issues about which I have secured information are: Jones County $50,000; Copiah County $25,000; Lauderdale County $100,000; Union County $35,000; Benton County $20,000; Jackson County $3,000; and Greene County $10,000. Other issues in 1913 are as follows: Alcorn County $10,000; Copiah County $75,000; Forrest County $100,000; Hinds County $200,000; Itawamba County $65,000; Jackson County $47,000; Lee County $40,000; Madison $50,000; Lincoln $50,000; Neshoba County $100,000; Montgomery County $40,000; Noxubee County $125,000 Pike County $200,000; Pearl River $25,000; Quitman County $5,000; Rankin $55,000 (1911); Scott $25,000; Warren $303,100; Lauderdale $170,000; Covington County $75,000 and $50,000 in 1911; and Lafayette $75,000 Copiah has only issued as a total including new issues $253,000. Leflore fell down on their $200,000 as shown in *1913 Year Book.*

The average costs of sand clay road will run about $1000 a mile; gravel roads $3500 to $5000 a mile; and macadam $4500 to $7500.

The tax rate has been increased in counties improving their roads an average of 1½ mills.

No funds available for road work from State as yet. Legislature is in session and may appropriate sufficient to establish a State highway department to have supervision over the location and construction of the various projects.

I would estimate that the various counties, supervisors districts, etc., in Mississippi this year will float bonds to the extent of $1,500,000 for the purpose of highway construction.

A. T. WITBECK, C.E.

Missouri

When the writer took charge of the State Highway Department he specified that the width of a highway should be at least forty feet, that it should have a roadway on the same thirty feet wide; should be raised at least 2½ feet in the center; that the culverts should be at least twenty feet and if possible thirty feet; that the bridges should be twenty feet with cement floors, where it is possible to get the county courts to make them that wide; that hedges should be cut to five feet in heighth, that they should be entirely eliminated as well as all other obstructions 150 feet back from corners as a matter of safety; that corners should be rounded; that jogs in roads caused by error in surveying should be made in shape of S-shaped turns; and other improvements in this manner, and our people have taken up the requests by complying with them.

Governor Elliott W. Major of this State issued a proclamation for the days of August 21st and 22nd to be made "Good Road Days", and practically in all parts of the State work was done, and the fine thing about it was that it was continued in these different communities, so that a very large amount of work has been completed.

Great interest is being taken in our State, meetings are being held in the same, and the writer has many invitations to address the different gatherings.

The *St. Louis Republic* raised a fund, which was turned over to the writer, for the buying of good roads machinery, and this machinery has been bought and placed in different portions of the State, and in addition thereto other machinery has been purchased or presented to our department. During the year our department has been very vigorously pushing the buying of large tractors, those that develop about 75 horse power, at the belt, to be used in grading our road systems, the plan being to use graders that are heavy and strong in tandem behind these tractors.

The road drag law, which is the one which names a county seat to county seat road to be selected by three commissioners, appointed by the county court, who select the roads to the next county seat, in connection with the commissioners from the adjoining counties, and these roads are then approved and inspected by the writer, who allows them, if in his opinion they are properly located, or sufficient interest is taken.

The benefit assessment law passed in our State, whereby farmers and others adjacent to a road, could lay out a district, was declared invalid by our supreme court, but upon being urged to re-hear the case, they have done so, but at this time they have not stated whether they would reverse their decision or not. This is a very popular law.

Our eight-mile road district law, which takes in districts adjacent to incorporated towns and cities, which may be extended, is a law that is quite popular.

The highway department has been limited a great deal by funds, the appropriation being very light, but from the large amount of work that has been started, it is quite possible that at the next session of the legislature, other appropriations will be granted.

F. W. Buffum,
State Highway Commissioner.

Montana

No progress report received in time for publication.

Nebraska

The State engineer, Mr. D. D. Price, reports that the State advisory highway commission is composed of three members who are not paid any salary or expenses. Such work as has been done during the year has been largely under the direction of Mr. Price. He states that his time has been practically taken up with designing bridges and looking after bridge work under the State aid bridge law and also under the law passed at the last session requiring that all county bridges costing over $500 shall be designed and built from plans and specifications prepared by the State engineer. He states that his office has practically completed a standard set of plans and that the work of collecting statistics on road work will be undertaken about March or April, 1914.

Nevada

There have been no changes in the highway laws of this State since I sent you the last report on that subject. Our last legislature failed to make any appropriation to continue the construction of roads with convict labor and there is no work being carried on at this time under that law.

A great deal of work is being carried on by the individual counties, under the law which permits the county commissioners to appoint road supervisors to repair and construct county roads.

It is the plan of the present administration to obtain statistics regarding the best method of constructing roads and to recommend to the legislature the passage of a law which will enable the State to carry out the construction of roads in a definite and comprehensive plan which will result in permanent highways and to construct a system which will be best for the State and the transcontinental traffic.

W. M. KEARNEY,
State Engineer.

New Hampshire

The total length of roads in the State is estimated, to be approximately 15,116 miles of which it is estimated that 840 miles consist of hard surfaced roads. Considerable of this mileage is gravel composed of hard pan (clay and metal, the latter being not less than 60 per cent of the total). About 130 miles of road have been completed entirely at the expense of the State, but most of these are only graded roads. There are no State roads under construction. The total mileage of all roads completed partly at the expense of the State and partly by local subdivisions is 840 miles, and no mileage is reported uncompleted. A total of 130 miles of State roads is now being maintained by the State. All roads built at the partial cost of the State are maintained under the supervision of the State highway department with contributions from the town and the State. The total expenditure by the State in 1913 for construction was $313,000 and for maintenance $65,000, in connection with which the towns expended $175,000 for construction and $65,000 for maintenance. A new State bond issue of $300,000 was authorized by the legislature in 1913. No convict labor was used in road work .

S. PERCY HOOKER,
State Superintendent of Highways.

New Jersey

No progress report received from the State department of public roads in time for publication.

New Mexico

As a general statement, highway construction in the State of New Mexico has some serious problems to contend with, not encountered in the more humid States, and further it may be said that within the boundaries of the State we are singularly blessed with great extensive areas wherein road construction is unnecessary. In other words, it would almost be criminal to work or touch the present native wagon tracks over these great areas.

The several types of roads in existence and under construction will be described in some detail and may be of interest.

CLIMATIC CONDITIONS

The precipitation throughout the State is very variable both annually and in periods of cycles of years. The rainfall varies from a mean of 8 inches annually in the lower valleys and plains to 25 and 30 inches in the higher mountains. The rainfall in the valleys at times may reach its mean annual precipitation within two or three months, leaving nine or ten months of almost absolute drought. In the mountains the mean annual may be precipitated in the form of snow during the winter months and proportionately small rainfall in the summer period, or it may be vice versa. These climatic changes are one of the factors which preclude systematic dragging of roads.

TOPOGRAPHY

The area of the State is 122,469 square miles; population is 350,000. Within the State altitudes ranging from elevations of 4000 to 6000 or 7000 feet above sea level are found, and great flat mesas or plains covering probably more than half the area. Over the balance of the State four mountain ranges traverse the State from north to south. The Rio Grande, its main stream system, traverses the State in a north to south direction, dividing it in half. The mesas are generally formed of clay and gravel deposits and proportioned by nature in their mixtures to maintain roads for large traffic without any amount of work. The mountains are typical of the western ranges and furnish ready material for construction work. The areas along the river valleys may be divided into three types, namely, the sandy stretches, river soil or adobe, and the irrigated tracts, each requiring a different type of road construction.

ROAD TYPES

No. 1. Mesas

During the early history of the territory, the roads traveled by the pioneers sought naturally the straight routes over these mesas. These roads made by the wagon wheels alone are in good preservation today, and it is only in crossing the drainages, which are few and far apart, that work is being carried on. These ancient roads have been generally adopted in the State highway system where convenient for inter-county and inter-State traffic. New roads of this type are being constructed by a lister plow point on the ends of timbers dragged and spaced from 56 inches to 60 inches apart. Several miles of road work a day may be made by these plows. This type of road approximates probably one-half of the mileage of the State highway system.

No. 2. Mountains

These roads are built of material from the side hill cuts, crowned and turned. Secondary drains are also constructed paralleling the roadside ditch to prevent practically all water from reaching the ditch along the side of the road. A maximum grade of 6 per cent is adhered to on the State roads. The road is surfaced with decomposed granites, lime or sandstones near at hand.

No. 3. River and valley

a. Sand stretches.—Clay covering to 6 or 8 inches is placed over the alignment. Gravel is placed over the clay to 9 inches in depth. The road is then left for traffic and rains to compact. This takes place within say six months, more or less, according to rains. During this period following the rains dragging is resorted to. Splendid success has followed this method.

b. Adobe stretches.—Standard types of graders are used for ditching and crowning. Gravel is then placed and in a similar period and manner as stated in the above paragraph, the road finally becomes in good shape.

c. Irrigated land.—Roads in these districts are graded by slips, fresnos, or graders, as convenient. These roads are gravelled, wetted and rolled. This puts the road immediately in shape for traffic.

STRUCTURES

Perennial streams are being bridged by steel spans and concrete arches. Culverts in the valleys are of mass and reinforced concrete. Sand arroyas are crossed by pile bent structures where the gradient is steep; where the gradient is light, concrete or stone walls (acting as weirs) are constructed along side the lower edge of the road. Some types of arroyas of this class, namely, the low gradient, a concrete floor full width of roadway, anchored by piling or cut off walls and piers are constructed. These are of a permanent nature, generally cheaper than bridging and may have water crossing them only a few hours in a year.

DRAGGING

Dragging is practical upon the roads through the irrigated sections. This is possible owing to the fact that habitation is centered along these tracts. It is impractical on the roads over the long sand and adobe stretches to drag this class of roads following rains, owing to the scarcity of inhabitants being available for this work. It is also impractical in these cases for dragging where an inhabitant is many miles from the road in need of dragging, for the reason that evaporation rapidly dries up these stretches.

ORGANIZATION

The road work is carried on by the State highway commission, organized under the State highway act of 1912.

FINANCIAL

The State highway commission is expending a fund obtained by a mill levy tax upon each dollar of the assessed valuation of the property in the State. This amount (estimated for 1914) $82,000 with the automobile tax, forest reserve and special levies, gives the commission approximately $120,400 for the coming year.

The counties by levy have for 1914 some $266,000. These estimates are given in detail further along in this letter.

A State bond issue of $500,000 was legalized by the last legislature, but to this time has not been sold, but a great many inquiries from the various bond buyers throughout the country make it appear that these bonds may be sold this coming year. This bond issue is to be expended by the State highway commission and proportioned out to the counties according to the amount of money turned in by each county according to the mill levy of the preceding year.

One county, Dona Ana, has already issued local bonds for their county and has at this time expended $82,000 of a total of $100,000 bond issue. As this bond issue is nearing its end in being expended, the county is now proposing to issue another issue of $50,000. This county has built approximately 45 miles of gravel road under these bonds.

ROAD SYSTEM

The State highway commission has designated a system of highways approximately, 3710 miles in length. Of this system 50 per cent may be classed under type No. 1. From 1909 to 1912 there was graded and improved 460 miles of road; during 1912, 245 miles were graded and improved. In 1913 approximately 56 miles of road were graveled in the State. It is impossible to estimate at this time the amount of work accomplished by the counties.

New York

The report of the State commissioner of highways for the year 1913 shows that of the original $50,000,000 bond issue there has been actually expended on contracts $40,951,002.12 and that there is obligated on existing contracts or by expedited routes $9,048,997.88, thus accounting for the entire issue. Of the second $50,000,000 bond issue, $5,000,000 has been appropriated by the legislature, of which $1,369,265.25 is obligated by contracts leaving $3,630,734.75 unobligated.

There are now nine divisions in the State each under the supervision of a division engineer. These engineers are appointed upon certification of the State civil service commission. To each of these engineers is assigned a resident engineer who acts as a deputy. To each county is assigned a chief assistant engineer, and in some of the counties two men are assigned who have charge of maintenance and repair. The commission with the approval of the civil service commission appointed a board of advisory engineers consisting of Mr. Harld Parker, of Massachusetts, Mr. George C. Diehl, of Buffalo, and Mr. Wm. DeHetburn Washington, of New York.

New specifications were adopted on January 15, 1914, and new roads will be constructed under these specifications. A geological survey has been partially completed of approximately 7000 miles of uncompleted portions of the main highway routes. Charts will be prepared showing the location of stone, gravel and sand deposits, on these roads. A guarantee is required of the contractor on the wearing surface of all highways except water-bound macadam and cement concrete for a period of three years. This places the responsibility for the selection of materials upon the contractor and leaves him the liberty of purchasing his material wherever he chooses to do so.

A bill has been introduced into the Legislature asking for an appropriation of $10,000,000 of which $5,000,000 is to become available at once and $5,000,000 is to become available October 1, 1914. Twenty million dollars of the second bond issue is required to be apportioned among the counties for State roads and $30,000,000 for county roads, the apportionment to be contributed on the basis of the population, mileage of highways outside of cities and villages, and the total area of the counties. The report calls attention to the fact that the law provides for the apportionment without taking into consideration the roads already constructed or to be constructed and as a result, there is either a deficit or a surplus apportioned to each county over and above the amounts necessary to complete both the State and county highways. Basing the cost of State highways on an average of $13,000 per mile the deficit in different counties amounts to $7,676,000 and the surplus among other counties to $3,964,000, while, under the law, the commissioner has been obliged to apportion some of the counties large amounts of money although the State mileage has already been completed. The same condition prevails with reference to the county roads and the commissioner calls attention to the fact that if these roads continue to cost $13,000 per mile there will be a deficit of $25,000,000. The construction of roads at moderate cost is urged as under the present system only 12,000 miles out of a total of 80,000 miles can, in any event, be completed.

Recommendation is made that some of the State convicts be utilized in the construction of State and county highways.

On May 1, 1913 the commissioner found in existence 325 contracts covering over 2000 miles of road, involving an expenditure of over $28,000,000. Practically the greater part of these contracts were closed during the construction season of 1913, and during the year 57 contracts were awarded obligating $1,369,265.25 as the State's share.

In May 1913 the bureau of maintenance was abolished and the organization for maintenance work, consolidated with the organization for construction. There were 4000 miles of completed road, for which it was necessary to provide maintenance. Fifty repair contracts involving $733,396 were awarded. Under a law enacted in 1913 the sum of $3,350,000 will be appropriated for maintenance, and according to the report, this amount has either been appropriated or obligated by the department for repair of roads this spring. During the year approximately 1000 miles of State and county highways were completed making in round numbers 5000 miles of State and county highways to be maintained and repaired during the coming year. It is estimated that to place this road system in proper repair and keep it well maintained a sum of at least $4,838,417 should be appropriated for the next year. The patrol system is declared to be not entirely satisfactory and it is believed that section gangs may give better satisfaction. During the coming year both the patrol and the section gang methods will be carefully studied.

In the system of town highways are included all public highways which do not form part of the State or county improved systems or county roads. The length of town highways is approximately 75,000 miles. There have been constructed by the towns during the current year 464 miles of macadam highway, ranging in cost from $1200 to $3000 per mile; there have been constructed 365 miles of gravel road at a cost ranging from $500 to $1500 per mile; there has been constructed 13,381 permanent culverts and 968 concrete bridges by the town superintendents.

North Carolina

The State does not make any direct appropriation for highway improvement but the State geologic board is authorized to make investigations and give advice concerning highway improvement, and an annual appropriation of $5000 is made for this purpose. The legislature of 1913 authorized the working of State convicts on two special highways in the State; one in Henderson county known as the "Hickory Nut Gap Road" and one in Madison county as a link of the central highway. Altogether ninety-two convicts are at work on these highways, fifty in Henderson and forty-two in Madison county. The State pays the entire cost of feeding, guarding, and carrying for the convict. The work is done under the supervision of the geological survey.

At the special session of the general assembly held in September 1913 a law was passed providing that county, townships or good roads districts desiring to use convict labor for highway improvement shall apply to the geological survey for plans or approval of plans for the work after which application shall be made to the board of state prison directors for the number of convicts desired for the work. The work done with these convicts is to be under the direction of the State geological survey. The law further provides that counties, townships or road districts using convict labor shall pay to the State not less than $1 per day for each laborer, furnish quarters, firewood for camp use and overseers to direct the work and that all other expenses shall be borne by the State board of prison directors.

JOSEPH HYDE PRATT,
State Geologist.

North Dakota

The State of North Dakota has made some progress in the interests of good roads during the year just closed. The 1913 legislative assembly passed a proposed amendment to the State constitution which is to give the State the power to grant aid in highway construction. This proposed amendment will be submitted to the people for an expression of their will at the general election of 1914 and it is expected that it will be adopted. A campaign of education has been carried on by various organizations and the sentiment is much more favorable for State aid than ever before. It is therefore probable that at the 1915 session of the legislature a State aid law will be enacted. The 1913 assembly also created a State highway commission consisting of the governor of the State, the State engineer, and one member to be appointed by the governor, the governor being chairman of the commission and the State engineer the secretary. No funds have been placed at the disposal of the commission and the members serve without compensation their duties being largely advisory. It is the duty of the commission to require the State engineer to prepare county maps showing the location of bridges and culverts and all the roads now being used. This work is now nicely under way. The highway commission also is to prepare maps showing proposed State highways.

A law was enacted also at the last session of the legislature making it the duty of the State engineer to prepare plans and specifications of bridges and culverts when requested to do so by county commissioners or township supervisors or others having jurisdiction over highway work. The office has made a number of plans of both bridges and culverts under this law.

Counties are now enabled to employ convict labor on roads. Counties taking advantage of this law are required to pay the men at the rate of 25 cents per day and to pay the guards provided by the warden of the penitentiary as well as provide board for the convicts.

The 1911 legislature created the office of county superintendent of highways leaving it optional with the counties as to whether or not they should establish such office. There have not been more than five such county superintendents serving at any one time. At present the following superintendents are serving: Billings county T. G. Plomasen, Beach; Dickey county, Sol Hunter, Oakes; Griggs county, Martin Ueland, Cooperstown; McKenzie county, Chas. Martin, Schafer; Stark county, W. R. Veigel, Dickinson.

The automobile license law which has been in effect since 1911 has resulted in a refund to the counties of the State of $17,661 in 1911, $22,800 in 1912, and $33,660 in 1913. These funds are expended in the maintenance of highways under the direction of county superintendents of highways or of county commissioners.

JAY W. BLISS,
State Engineer.

Ohio

The State highway commissioner submits tabular information showing mileage, cost, and types of road, etc., during each year from 1905 to 1913, inclusive, as follows: road mileage constructed 1908, 62.69 miles, contract cost $453,581.15; 1909, 63.01 miles, contract cost $534,945.77; 1910, 72.87 miles, contract cost $627,574.18; 1911, 60.83 miles, contract cost, $455,419.11; 1912, 161.28 miles, contract cost $1,389,742.85; 1913, 157.61 miles, contract cost $1,386,505.26, a total of 578.29 miles at a total contract cost of $4,847,768.32, or an average cost per mile of $8383. Of this total mileage 131.13 miles is of brick, 60 miles of plain concrete, 5.43 miles of bituminous concrete, 333.52 miles of plain macadam, 40.4 miles of bituminous macadam and 5.60 miles of gravel. The 1912–13 work comprised 29.30 miles of brick, 22.30 miles of plain concrete, and 106.01 miles of plain macadam, or a total of 157.61 miles. The engineering costs during 1908–09 comprised 5.19 per cent of the total; in 1909–10 6.04 per cent of the total; in 1910–11 7.20 per cent of the total; in 1911–12 6.05 per cent; 1912–13 6.34 per cent of the total.

Oklahoma

The State highway commissioner reports under date of December 13, 1913, that no change has occurred since the biennial report of January 1, 1913. The report was that the State highway department was organized July 1, 1911 under a law providing that the department should be supported by automobile fees. The automobile law provided that a fee of $1 should be paid for each automobile operated in the State and that from the fund thus derived $9000 should be paid for the salary of the State highway commissioner and the expenses of his office.

Considerable educational work was done by the department; standard designs for highway bridges of concrete and steel were developed and prepared; bulletins issued on bridge and culvert work; a general highway plan of the State prepared; and statistics assembled showing the road conditions in each county. It was ascertained that the total road and bridge fund for 74 counties was $1,307,461.60 making an average county and road bridge fund of $17,668.40. The township tax levy was $1,839,218.24 and the cash value of the poll tax was $731.120 making a total of $3,877,799.84 for the fiscal year ending June 30, 1912, exclusive of bonds.

The commissioner estimates that the State is losing at least a half million dollars a year on account of inferior bridges and culverts and he calls attention to the fact that during the rains early in the year 1912, $400,000 worth of bridges and culverts were washed out and must be replaced. His report was that the length of road open for travel in the State aggregated 79,883 miles, of which 499 miles were improved.

Oregon

No State road work has been done so far in Oregon. During 1914 approximately $240,000 will be spent by the State highway commission on a State road. This money is provided by a quarter mill tax for State road purposes.

From the best data available there are approximately thirty-three thousand miles of road in Oregon.

There are approximately twenty miles of hard-surfaced road in the State.

During the eleven years from 1903 to 1914 there has been expended on roads and bridges in Oregon, under county supervision, approximately $18,000,000.

H. L. Bowlby,
State Highway Engineer.

Pennsylvania

1. Total mileage, 97,900 miles.

2. About 1225 miles improved by the State with metal surface, and in addition there are 475 miles of improved toll roads on State highway routes. No data on township or county roads.

3. Mileage completed at total expense of State is 269 miles on December 31, 1913.

4. Mileage not completed under contract at total expense of State is 11.1 miles on December 31, 1913.

5. Mileage of State aid highways built under the provisions of acts since June 1, 1911, is 61.1 miles, and 905.1 miles of State aid highways were built under the provisions of acts previous to June 1, 1911, making a total of 960 miles completed.

6. Mileage of State aid contracts not completed December 31, 1913, is 37 miles.

7. Total miles now being maintained at total expense of State is 8827.

8. Of the 960 miles of improved roads built by State-aid, about 385 miles are not on State highways, and are maintained by the State and township or borough, each bearing 50 per cent of the expense. The remaining 575 miles of State aid highway are on State highways and maintained at total expense of the State. A small percentage of the above is constructed of brick and asphaltic concrete.

9. Contracts let during the current year:

	Miles
Telford macadam	7.64
Brick block	14.74
Asphaltic macadam	24.37
Asphaltic concrete	17.98
Total	64.73

Practically all highways are 16 feet wide. Some borough work is wider.

10. The total expenditure of funds from January 1, 1913, to December 31, 1913, was approximately $4,600,000 which amount was used from State aid fund (1909–1911), State highway fund, national road fund, and maintenance fund.

11. The Legislature of 1913 created a bureau of township highways under the jurisdiction of the highway commissioner. This department is empowered to furnish plans and specifications, approve contracts and advise the township supervisors in the discharge of their duties. All road taxes in the township must be paid in cash and the State pays to the townships, $0.50 for every dollar of road tax collected, not to exceed $20 per mile.

12. The department has organized a maintenance division under a maintenance and assistant maintenance engineer to do all maintenance work. The bureau of township highways has been organized under the direct control of the first deputy commissioner.

13. No financial progress. A proposed amendment to the constitution to issue bonds for State highway construction was defeated at the general election.

14. No convict labor was used.

15. Superintendents were schooled in the new system of maintenance.

16. Statement of unit costs of contracts let is attached.

17. Answer to no. 9 shows tendency from water-bound macadam toward more permanent construction.

JOHN T. GEPHART, JR.,
Acting Chief Engineer.

Rhode Island

The report of the State board of public roads issued January, 1914, emphasizes the seriousness of the maintenance question. The board states that the most serious problem with which it has struggled during the season of 1913 was that of maintaining without sufficient funds roads built seven, eight and ten years ago when methods of construction and tonnage of traffic per road mile were far different from those confronting the road builders of the past three years. About $150,000 was appropriated for maintenance, in addition to the $130,000 of automobile funds, and with this amount the board concentrated its efforts toward maintaining the sections subjected to the heaviest trunk line traffic. The constructed system of roads under the care and maintenance of the board on January 1, 1914 comprised approximately 325 miles consisting of 236 miles of water-bound macadam and 89 miles of bituminous macadam widely distributed among all of the counties of the State. The average cost of construction per mile including grading, drainage, guard rails, and engineering expenses, has been less than $7400. Since the creation of the board in 1902, there has been received for highway purposes by appropriations, by bond issues, from the automobile department and from fines, approximately $3,189,527.46 to January 1, 1914.

The board recommends to the legislature the adoption of a graded tariff of registration fees covering commercial motor vehicles as it considers the present flat rate of $2 per motor truck far from sufficient.

Although the State highway system as adopted by the legislature comprises approximately 683 miles, the board is by law responsible so far as maintenance is concerned for only such roads as have been constructed by the board and upon which they have caused work to be done. The total length or roads therefore to be maintained by the board in 1914 is 324.42 miles.

Of the 156 bridges along the line of State roads brought by an act of the legislature in 1912 under the care of the board, twenty-one have been rebuilt and most of the others repaired. Attention is called to the fact that wooden bridges still form one-third of the total number, and a record of the maintenance of bridges during the past year shows that by far the greater part of the money expended was in keeping these wooden bridges in safe condition.

South Carolina

The report of the commissioner of agriculture and industries for the year 1913 summarizes the highway conditions in the State to January 1, 1914 in the following table:

Public highway conditions—January 1, 1914

COUNTIES	AMOUNT OF PROPERTY TAX AVAILABLE FOR YEAR 1914	BOND ISSUE EXPENDITURES	NUMBER OF MEN SUBJECT TO ROAD DUTY	AVERAGE NUMBER OF DAYS REQUIRED TO WORK	AVERAGE WAGES PER DAY	POLL TAX INCOME AND INCOME FROM LABOR TAX	ASSESSED VALUATION OF PROPERTY SUBJECT TO TAXATION FOR ROADS AND BRIDGES	TAX RATE (MILLS)	TOTAL MILEAGE	EARTH	GRAVEL	SAND CLAY	PLAIN MACADAM	SUPERVISORS
Abbeville	$60,000	......	3,800	4	$1.00	$3,800	$ 6,027,738	......	2,000	......	......	......	......	W. A. Stevenson, Abbeville, S. C.
Aiken	27,000	......	4,235	4	1.00	4,500	11,379,060	......	1,200	751	100	340	......	John Staubes, Chief Commis., Aiken, S. C.
Anderson	......	......	7,000	3	1.00	7,000	18,014,365	......	6,000	6,000	......	......	......	J. S. Acker, Anderson, S. C.
Bamberg	1,565	......	1,800	......	1.00	3,600	3,120,860	½	400	300	......	100	......	E. C. Bruce, Bamberg, S. C.
Barnwell	......	......	4,500	......	......	6,700	6,196,070	......	1,000	......	......	450	......	G. J. Diamond, Barnwell, S. C.
Beaufort	10,000	......	3,000	8	1.00	1,000	3,247,615	4½	350	50	......	......	......	J. B. Walker, Beaufort, S. C.
Berkeley	5,500	......	2,500	......	1.00	3,500	3,500,000	1	600	100	......	......	......	J. W. Hill, Monks Corner, S. C.
Calhoun	1,875	......	2,400	......	.75	4,800	2,508,000	¾	400	200	......	300	......	W. J. Wise, St. Matthews, S. C.
Charleston	2,500	......	7,000	8	1.15	1,300	27,451,166	......	......	......	......	......	......	*W. P. Cantwell, Charleston, S. C.
Cherokee	25,000	......	2,500	3	.90	2,800	5,500,000	4	800	600	......	......	......	E. A. Lipscomb, Gaffney, S. C.
Chester	20,000	......	......	......	.75	7,000	7,021,799	......	700	......	......	......	15	J. O. Darby, Chester, S. C.
Chesterfield	8,000	......	2,785	5	1.00	6,070	4,000,000	2	500	442	8	50	......	H. F. King, Chesterfield, S. C.
Clarendon	8,067	......	4,500	6	.75	9,000	4,305,925	4½	125	......	......	125	......	W. R. Davis, Manning, S. C.
Colleton	20,000	......	1,250	......	1.00	......	4,000,000	3	1,000	850	100	50	......	J. W. Hill, Walterboro, S. C.
Darlington	5,000	......	4,800	6	1.00	5,000	6,329,138	......	1,050	300	......	400	......	C. W. Milling, Darlington, S. C.
Dillon	15,500	......	3,000	6	1.00	6,000	3,913,720	4	1,000	200	......	140	......	Wade Stackhouse, C'man Board of Commis., Dillon, S. C.
Dorchester	4,000	......	1,500	......	1.00	3,000	3,300,000	......	350	350	......	......	......	J. D. Winberly, St. George, S.C.
Edgefield	......	......	3,500	6	.75	5,198	4,415,653	......	......	......	......	......	......	A. A. Edmonds, Edgefield, S. C.
Fairfield	10,000	......	4,000	......	.75	3,000	5,000,000	1½	650	125	......	......	......	D. R. Coleman, Jr., Winnsboro, S. C.
Florence	......	......	......	4	1.00	4,000	7,863,504	2	1,100	400	25	275	......	J. B. McBride, Florence, S. C.
Georgetown	18,000	......	2,500	......	1.00	5,000	4,119,166	......	500	300	......	75	......	Geo. D. Anderson, Georgetown, S. C.
Greenville	70,000	......	5,000	3	1.25	5,000	15,654,540	......	3,000	1,500	......	......	10	G. O. Bramlett, Greenville, S. C.
Greenwood	24,000	......	4,000	6	1.00	4,000	7,000,000	3½	1,800	......	......	......	......	J. B. McCombs, Greenwood, S. C
Hampton	......	......	......	......	2.00	5,311	3,160,368	7	1,000	300	......	2	......	B. H. Tuten, Hampton, S. C.
Horry	13,598	......	4,000	6	1.00	1,164	3,068,825	3	2,500	......	......	......	......	A. C. Murrell, Conway, S. C.
Jasper	7,500	......	1,000	......	......	......	2,551,034	......	......	......	......	......	......	G. L. Langford, Ridgeland, S. C.
Kershaw	12,357	......	......	......	......	6,974	4,978,481	2½	......	......	......	......	......	M. C. West, Camden, S. C.
Lancaster	22,000	......	......	......	1.00	11,000	3,000,000	5	600	10	......	30	......	T. O. Blackmon, Lancaster, S. C.

* Reid Whitford, Engineer Sanitary and Drainage Commission.

Public highway conditions—January 1, 1914—Continued

COUNTIES	AMOUNT OF PROPERTY TAX AVAILABLE FOR YEAR 1914	BOND ISSUE EXPENDITURES	NUMBER OF MEN SUBJECT TO ROAD DUTY	AVERAGE NUMBER OF DAYS REQUIRED TO WORK	AVERAGE WAGES PER DAY	POLL TAX INCOME AND INCOME FROM LABOR TAX	ASSESSED VALUATION OF PROPERTY SUBJECT TO TAXATION FOR ROADS AND BRIDGES	TAX RATE (MILLS)	TOTAL MILEAGE	EARTH	GRAVEL	SAND CLAY	PLAIN MACADAM	SUPERVISORS
Laurens	$21,600	......	4,000	......	$ .75	$6,000	$7,235,000	3	1,800	150	......	......	......	H. B. Humbert, Laurens, C. C.
Lee	......	......	3,800	......	1.00	7,600	3,504,750	......	500	200	......	90	......	C. T. Evans, Bishopville, S. C.
Lexington	10,000	......	3,500	3	1.00	3,223	5,395,317	2	1,400	73	......	87	......	C. E. Corley, Lexington, S. C.
Marion	3,786	......	1,800	6	1.00	3,500	3,785,893	1	360	21	......	41	......	†W. B. R. Gasque, Marion, S. C.
Marlboro	12,800	......	4,000	6	1.00	6,000	4,832,324	2½	500	100	25	30	......	M. E. Coward, Bennettsville, S. C.
Newberry	7,000	......	3,000	6	.75	4,000	7,000,000	1	......	......	......	......	......	J. H. Chappell, Newberry, S. C.
Oconee	20,000	......	5,000	4	1.00	5,000	5,000,000	......	1,500	20	......	......	......	W. F. Foster, Walhalla, S. C.
Orangeburg	30,000	......	......	......	......	9,500	8,500,000	4	2,750	1,000	......	1,500	......	J. Leroy Dukes, Clerk, Orangeburg, S. C.
Pickens	26,000	......	3,000	......	1.00	3,000	4,026,964	5	2,500	......	......	......	......	J. B. Craig, Pickens, S. C.
Richland	79,176	......	9,176	......	1.00	......	18,352,011	¾	......	165	......	235	½	A. Patterson, Jr., Columbia, S. C.
Saluda	10,000	......	4,000	5	.75	......	2,643,000	......	550	150	......	......	......	G. W. Langford, Saluda, S. C.
Spartanburg	68,000	......	7,234	3	1.00	11,878	19,000,000	4½	1,800	200	......	......	15	D. M. Mills, Spartanburg, S. C.
Sumter	7,000	$10000	......	......	......	9,000	7,758,392	5¾	500	250	......	150	......	P. M. Pitts, Sumter, S. C.
Union	16,748	......	4,000	3	1.00	2,250	6,700,000	2½	663	210	......	......	8	Wade H. Howell, Clerk, Union, S. C.
Williamsburg	20,091	......	5,143	......	1.25	10,286	4,902,505	2	1,000	900	......	100	......	Jno. M. Eddy, Engineer, Kingstree, S. C.
York	13,029	......	......	5	1.00	11,000	9,300,130	1½	1,100	124	18	40	10	T. W. Boyd, Yorkville, S. C.
	$695,660					$227,954	......	......	45,548	16,341	276	4,519	58	

† J. M. Johnson, Chairman Marion Highway Commission.

South Dakota

There is no provision in the road laws of the State for State aid or control of the highways. Until July 1911 we had no laws on the subject except the old pathmaster system of ordering out the citizens for a day or two to work out the poll tax and additional property road tax in most cases light if any at all. Results were no roads were completed—and in most cases proved only a waste of time and energy.

We are now operating under a road contract law passed in 1911. All maintenance of the roads and all contract work under value of $250 is in charge of the township supervisors who are the road officers. All contract work over $250 which will include real expensive road work of the county is in charge of the county commissioners who are the road officers of each county.

While we are at the foot of the ladder in amount of money appropriated in this State, yet we have proof that sentiment is rapidly gaining, that good roads pay for themselves and that road improvement should not be classed as an expense but an investment. In 1912 less than $100,000 was expended by counties and that about all in the Black Hills in the western part of the State. In 1913 fifty-three counties levied a total of $561,622 being more than four times as much as in 1912. This is saying nothing of the levies by townships in the State to take care of the maintenance and contract work under $250 which roughly estimated I think was another half million dollars. (We enclose table by counties as levied in 1913.) We look for greater improvement than ever before in the history of the State in 1914.

The total mileage of roads in the State unimproved and all kinds of improved roads are about in miles 200,000. Of this there are improved more or less, but most all splendid dirt roads 29,000 miles. Total miles of hard surface roads, graveled, paved or brick 1000 miles. We have little or no sand clay roads except in Black Hills, and I classed same with dirt roads.

There were no roads built by expense of the State. The only instance is the Federal Forest where the government turned over to the State $3750 which was expended on good roads in the counties where the forest is located. The Government also expended directly on roads $4200.

There is nothing in the State at present in the way of contracts for roads not completed. This being in a latitude where no work is done between November and April.

Our State highway department was not created until July 1913 and no funds were allowed us by the legislature, therefore, there were no roads constructed under our supervision. Our work is in counseling, giving assistance, advice and altogether merely educational. Much was done in our State the past year along educational lines.

No other changes in legislation or organization in 1913 except as to cutting weeds and removing rocks from the highways, there being a law now to remove both weeds and rocks.

Altogether we are optimistic as to the near future developments on road building in this State. The Cross State Highway have helped materially in awakening public interest. Chief interest in South Dakota has become concentrated on several important trunk line roads which may be designated as the Meridan Road or Winnipeg to Gulf Highway: The Chicago, Black Hills, Yellowstone Park to Coast Highway; the Minneapolis, Aberdeen Yellowstone Road; the Watertown, Redfield, Gettysburg, Belle Fourche Road; the Sioux Falls, Salem, Iroquois Road; the South Dakota Scenic Highway; and the Sioux City Platte, Chambelain Road. It is proposed to improve existing roads as far as practical and the program contemplates the construction of good earth roads.

E. C. ISSENHUTH,
Chairman State Highway Commission.

Tennessee

1913 brought to a successful completion roads and pike systems in several counties, bond issues for same having been voted during 1912. This was particularly true in Robertson, Carter, Washington, Sullivan, Roane, Cumberland and other counties, while in the counties of Knox, Hamilton, Davidson and Shelby, there is work constantly going on in improving and extending pike systems. During the session of the legislature in 1913 two enabling acts were passed, which will materially assist the cause of good roads in Tennessee, namely; A general enabling act defining a road district and permitting sections of counties to hold an election for the purpose of raising money for road construction and improvement, and also an enabling act permitting counties to vote bonds for improving and building public roads, without the necessity of a special enabling act. In the provisions of these two acts the cause of good roads in Tennessee will be greatly strengthened for the reason that in the event the county fails to vote bonds it will not be necessary to wait until another bi-annual session of the legislature for permission to hold another election, but an election can be held as often as desired. Furthermore, should the good roads advocates of any county fail to carry the election by reason of strong opposition in any particular section, the district embracing the territory not exceeding 12 square miles, can hold an election and vote bonds for the improvement and construction of public roads.

While the interest in the Memphis to Bristol Highway has abated to some extent, yet rapid stride is being made in the completion of this State highway. For instance during 1913 Cheatam and Dickson counties voted bonds for the building of their links which is now under way and Davidson has practically finished the extension of its pike to the Cheatam county line. This will only leave three counties of the western division unprovided for and in one of the three, Benton, an election will be held during 1914.

C. C. GILBERT,
Secretary Tennessee Manufacturers Association.

Texas

No State highway department exists and hence it is impracticable to obtain at the present time a comprehensive progress report for the State.

Utah

No progress report received in time for publication.

Vermont

Our work has proceeded in 1913 along our regular lines, with but little of a spectacular nature to bring to attention. We expended on improvement of our selected highways, which are 4000 miles out of 15,000, some $500,000. By improvement, we mean construction. On maintenance, we expended something over $200,000. Of these amounts, some $115,000 for improvement was supplied from the towns, as well as over $100,000 for maintenance.

Our type of road remains the same, gravel or gravel-telford. Our plan of improvement remains the same—building no long stretches of road, but constantly improving the worst places throughout the entire system of 4000 miles. In this way, we have very poor roads at all, after the spring roads are dried out, and we have hundreds of miles of very delightful roads for the public travel. We have built some 200 miles of road in 1913. We are not aware of any known type of road, that will answer the needs of Vermont so well as earth roads.

M. E. SHEDD,
Clerk.

Virginia

The report of the State highway commissioner for the year ended September 30, 1913, gives the mileage of the various types of road constructed since the establishment of the department as follows: 1907, 24 miles comprising 6 miles of sand clay and 18 miles of macadam; 1908, 51.80 miles, comprising 20 miles of gravel and 31.80 miles of macadam; 1909, 137.58 miles, comprising 39.37 miles of soil or sand clay, 30.91 miles of gravel, 67.30 miles of macadam; in 1910, 290.07 miles comprising 90.20 miles of soil or sand clay, 74.60 miles of gravel, and 125.27 miles of macadam; 1911, 395.86 miles comprising 53.71 miles grading to be macadamized, 139.36 miles of soil or sand clay, 83.70 miles of gravel and 119.05 miles of macadam; 1912, 542.63 miles, comprising 150.11 miles grading to be macadamized, 3.19 miles shell, 179.17 miles soil or sand clay, 63.39 miles gravel and 146.77 miles macadam; 1913, 619.33 miles comprising 73.22 miles grading to be macadamized 1.80 miles of better than macadam, 5.66 miles shell, 270.35 miles sand clay or soil, 98.65 miles gravel, and 169.65 miles macadam. This gives a total of 677.84 miles of macadam, 371.29 miles of gravel, 724.45 miles of soil or sand clay, 8.85 miles of shell, 1.80 miles better than macadam, 277.04 graded to be macadamized or a total of 2061.27 miles.

A comparison of the costs of road built with free labor and convict labor demonstrates that the convict labor has been used to greater advantage on the heavy work. The cost of convict labor per ten hour working day during the past year has been 50¾ cents.

Bonds have been issued by thirteen counties or magisterial districts during the past year as follows: Accomac (Lee District) $50,000; Dickenson (1 district) $32,000; Lee (2 districts) $76,000; Lunenburg (2 districts) $64,000; Nelson (1 district) $35,000; Rappahannock (2 districts) $64,000; Russell (1 district) $150,000; Smyth (2 districts) $225,000; Spotsylvania (2 districts) $100,000; Scott (3 districts) $167,100; Warren (2 districts) $60,000; Westmoreland (1 district) $25,000; Wise (2 districts) $260,000.

The average cost per mile of macadam road constructed during the fiscal year 1913, with the aid of State money and bond issues, was $5,690.12. The average cost of macadam roads built with convict labor was $4,360.23, and the average cost per mile for both money and convict labor was $5,027.49. The average cost per mile of gravel roads built with the aid of State money and bond issues was $1,424.20 and the average cost per mile with convict labor $1,611.17 making an average for both money and convict labor of $1,503.67. The average cost of sand clay or top soil roads constructed with the aid of State money and bond issues was $819.23, and the average cost with convict labor was $1,092.25 making the average for both money and convict labor $883.32.

Washington

No progress report received in time for publication.

West Virginia

The West Virginia road bureau was created by the acts of legislature of 1913. On the 8th day of July A. D. Williams of Marlinton was appointed chairman and chief road engineer, Geo. B. Chorpening of Clarksburg was appointed one member, one member not yet appointed, Dean E. D. Sanderson of the college of agriculture is a member by viture of his official position. The legislature established a department of highway engineering at the university. There are students taking the regular course in civil engineering, making highway their major subject.

Special road school for benefit of road supervisors, county engineers and county officials was held here February 10th to the 20th, 1914. The State has established a testing laboratory at the university, and arranged to work prison labor on the roads after October 1st, 1914, as the said labor is under contract until that time. The law provides that the prisoners in county jails shall work upon the public roads.

Bonds have been voted in the following counties: Marion $700,000, Mercer $500,000, Pleasants $60,000, Wetzel $150,000, Cabell $300,000, Hancock $350,000, Wood $180,000. The counties of Wood, Marion, Cabell and Hancock are constructing brick road. Logan county has voted $60,000 for bridges. The county of Mercer will construct macadam and earth road. The county of Wetzel will use the amount of $150,000 in regrading its road.

A. D. WILLIAMS,
Chief Road Engineer.

Wisconsin

The State aid law was passed by the legislature in 1911, and at that time an annual appropriation of $350,000 was made. This did not prove enough to meet the State's full one-third, as proposed by law, as 511 towns voted a total of $422,163 for road improvements, and 125 towns voted a total of $55,133 for bridge improvements.

In 1912 the amount available for State aid was $350,000 plus $28,000, the latter amount being the 25 per cent of the net proceeds of the automobile fund of the State. It was seen, however, that $378,000 was totally inadequate to meet the demands of the towns which asked for $816,000. When the legislature met in January last, they made an additional appropriation to meet the demands of the towns. There was, therefore, available for 1913 work $2,500,000 in round numbers, and the work done can be classified in miles of roads built as follows:

	Miles
Concrete roads	26
Stone macadam roads	290
Gravel macadam roads	155
Shale or clay surfaced roads	65
Graded but not surfaced	460
Total	996

Up to the present time the work has been confined to the towns. As a result the nine foot gravel, macadam and dirt road has been the leading type of construction. Wisconsin has about 63,000 miles of highways according to Government reports, and a population of two million and one-half. Almost four-fifths of these people live in rural districts, necessitating an extensive system of rural highways by which the farming, dairying, and stock raising population of the State can get their products to the railroad and market. The nine foot road has proved the most economical and practical at the present stage of industrial developments in the State, and this width of roadway will no doubt predominate for some time to come.

In evidence of the growth of the work under this system, I submit the figures showing the amounts voted by the towns, villages, and cities of the fourth class at the last spring election, the certifications of which are now complete. 1211 governmental units have voted $1,548,839.48. To this the counties will add $1,548,839.48, and the State, $1,230,000, making a total of $4,327,778.96. Of the $41,000 which constitutes the State's share of the proceeds from the automobile licenses, $30,000 of this amount has been added to the regular appropriation, thus making in all $1,230,000 allotted by the State to meet the votes of the towns.

For the first two years of operation the appropriation set aside by the legislature for administering the law was $40,000 annually. This was more than sufficient for the first year (1911–12). This amount was not enough, however, for 1912–13 work, and the legislature made an extra appropriation of $20,000 to meet the needs of last year, at the same time the appropriation of $450,000 was made, which was the amount appropriated to meet the inadequacy of the $378,000 referred to above.

The commission has tried to follow the motto "A dollar's worth of road for every dollar of tax." Economy and efficiency have been particularly emphasized, and it has been the practice of these principles which has contributed largely to the success and popularity of the road work in Wisconsin.

WILLIAM DAWSON,
Chief Clerk.

Wyoming

There is a total of about 15,000 miles of what are known as county roads, and in addition to this there are several thousand miles of roads that have been in use for years, but to which the county pays no attention. The State legislature has designated several routes aggregating over 2500 miles, which are known as State highways, and has provided for the employment of State convicts in the construction of such highways. There are over 1000 miles of road which have been improved by grading and providing drainage. These roads are mostly in the mountainous or hilly districts where the material is largely gravel or shale, so that a hard surface is not provided. The work of locating the State highways has progressed slowly, as the legislature has failed to provide any means for carrying on this work. It is only as the State engineer is able to interest the counties, that this work can be done.

By deputizing the county surveyor and having him paid by the county, nearly a thousand miles of State highways have been located. Of such roads, about 100 miles have been improved by convict labor. The last legislature designated about 600 miles of road as State highways. This is in addition to the 2000 miles laid out by the previous legislature. But few convicts have been available this year for road work, largely on account of construction work at the State penitentiary, where convicts who were eligible for outside work have been employed.

Considerable interest has been aroused in the State, owing to several through routes which have been designated to cross various parts of the State.

A. J. Parshall,
State Engineer.

ROAD EXPENDITURES 1913 AND FUNDS AVAILABLE 1914

Alabama

Road expenditures 1913 will approximate $1,900,000 when all reports from county treasurers to the State highway department are in.

Funds available 1914

From all counties for construction and maintenance roads and bridges	$2,100,000.00
From the State in State aid work	267,165.00
Total	$2,367,165.00

Bonds voted 1913

Marion County	$100,000.00
Crenshaw County	125,000.00
Cullman County	200,000.00
Blount County	150,000.00
Marshall County	125,000.00
	$700,000.00

W. S. Keller,
State Highway Engineer.

Arizona

The following table gives the amount of road funds available for road construction.

	1912-13	1913-14
Apache	$8,046.00	$11,000.00
Bond issue		30,000.00
Cochise	59,640.39	99,253.00
Coconino	20,538.00	23,578.00
Gila	27,750.00	50,497.00
Graham	2,825.00	8,019.00
Greenlee	17,729.00	76,823.00
Maricopa	75,586.00	72,963.00
Bond issue for special road districts Nos. 1, 2 and 3		40,000.00
Proposed		1,000,000.00
Mohave	15,354.00	18,277.00
Bond Issue		100,000.00
Navajo	10,354.00	17,745.00
Pima	28,575.00	30,062.00
Pinal	16,663.00	31,716.00
Santa Cruz	4,000.00	8,000.00
Yavapai	41,712.00	66,296.00
Yuma	6,969.00	21,495.00
Bond issue		500,000.00

Total county funds available exclusive of bonds, 1912–13, $335,724; 1913–14, $535,724.

LAMAR COBB,
State Engineer.

NOTE: State expenditure 1913—$274,631 and 40,925 days State convict labor. State funds available 1914—$258,577.—From *U. S. Office of Public Roads.*

Arkansas

The total amount of money which the State highway department will have for expenditure during 1914 will amount to $5 each for probably 5000 automobile licenses which will be issued, making in all $25,000. There are no other sources of revenue under the State law for funds to be expended by the highway department.

There is a law providing for a 3 mill tax, which must be voted biennially in each county of the State. There are not to exceed one-half a dozen counties in normal times that vote against this proposition any more, and the total amount of this fund for 1914 is $1,163,000. This fund, however, is entirely in the hands of the probate judge of each county to spend as he may direct in the various county districts. This is spent very largely through the overseers for the district, and, of course, a large portion of the money is wasted because of political work. Some of the larger counties, notably Pulaski, in which Little Rock is situated, Jefferson, in which Pine Bluff is situated, and Sebastian, in which Fort Smith is situated, have in recent years been awarded contracts for considerable bridge, road and street work, and there has been a tendency in the more settled districts to get away from the overseer proposition, and do better and more intelligent work.

E. A. KINGSLEY,
State Highway Engineer.

NOTE: Local expenditures 1912—$1,586,050.

California

I regret very much that I am unable to give you an estimate of the expenditures which will be made by the counties and townships during 1914 for road purposes.

This commission is engaged in the particular task of building the roads provided for by the $18,000,000 bond issue and little, if anything, is done in the way of securing statistics from the counties and cities and I know of no State department which is charged with this duty.

A. B. FLETCHER,
Highway Engineer.

NOTE: Expenditures by State highway commission 1913—$2,032,084; county road and bridge expenditures 1912—$6,228,527, exclusive of San Francisco County. State funds available, $15,500,000 as required, and about $350,000 automobile revenues for maintenance.—*From U. S. Office of Public Roads.*

Colorado

The funds available for expenditures by this department will amount to about $375,000 for this year, as near as we can estimate at this time.

In meeting this amount the counties will put up probably about $300,000. This amount will be spent on the State primary road system. In addition to this, the counties will raise by their tax levy for roads and bridges about $1,250,000, which will be spent on all roads other than State roads, although it is possible that about $250,000 of this later amount may be diverted to use upon the State road system. The amount that will be spent by the towns and cities is something which I can not give you, as their taxes for street purposes are spent entirely within the corporate limits of the town or city, and not upon the county or State roads.

The sources of the State fund are as follows:

Amount repaid from capitol building fund	$175,000
Receipts from automobile license	30,000
Amount to be realized from sale of old refunding bonds due to the internal improvement fund	52,000
Amount received from the internal improvement income and permanent fund	118,000
Total	$375,000

The county fund is raised entirely by direct levy for roads and bridge purposes.

J. E. MALONEY,
Secretary.

NOTE: State expenditures 1913—$448,000. Local expenditures 1912—$1,469,690.

Connecticut

The legislature of 1913 made an appropriation of $3,000,000 for road work, $2,000,000 of which was designated as trunk line fund and $1,000,000 as State aid fund. These appropriations run to September 30, 1915.

The appropriations for repairs on State aid roads and for administration purposes are the same as last year's appropriation. The receipts from automobile licenses will aggregate about $350,000 a year.

The State continues to pay three-quarters of the cost of State aid roads in towns with a grand list of over $1,250,000 and seven-eighths of the cost in towns having a grand list of said amount or less. The State also pays three-quarters of the expense of maintenance of State aid roads and the entire expense of the maintenance of trunk line highways.

C. J. NICHOLS,
Chief Clerk, State Highway Commission.

NOTE: Local expenditures 1912—$1,250,000.

Delaware

New Castle County, 1914

Balance of bond issue	$50,000
State fund	10,000
County fund	50,000
Total	$110,000

J. HARRY PIERSON,
Assistant to the Highway Commissioner.

NOTE: Local expenditures 1912.—$339,480—*From U. S. Office of Public Roads.*

Florida

Local expenditures 1912—$1,500,000. Highway and bridge bonds voted 1913—$2,665,000.—*From U. S. Office of Public Roads.*

Georgia

This department made no attempt to collect road statistics last year and consequently can give no data as to cost of roads for that year. I should think the amount to be expended on the roads for 1914 would be greater than any previous year, but how much I could not say.

S. W. McCALLIE,
State Geologist.

NOTE: County and district expenditure for 1912—$2,750,000.—*From U. S. Office of Public Roads.*

Idaho

Total amount of money expended during the year 1913, for highway work:

By State	$15,000
By counties for highway district	1,000,000
Total	$1,015,000

The amount available for 1914 is approximately as follows:

State funds

Balance on hand State road funds	$25,000
State highway bond issue	200,000
Motor vehicle tax (estimated)	50,000
Total State funds	$275,000

Other than State funds to be expended under direction of State highway department:

Estimated	$525,000
Estimated County and Highway District expenditure other than above	750,000
Grand total	$1,550,000

Five per cent of the above amount is to be regarded as set aside for maintenance. Of the above amount outside of the motor-vehicle tax, and possibly one-third of the county and highway district estimated tax levy, the balance of the total amount available exclusive of State funds, will probably be raised by the county and highway district bond issues.

County and highway district bonds issued 1913	$520,000
State bond issue	200,000
Total	$720,000

County bond issues proposed for 1914 (estimated) $750,000.

Ed. Smith,
State Highway Engineer.

Illinois

Funds available for State department

Appropriated for the work of Illinois highway department from July 1, 1913 to July 1, 1915	$200,000.00
Appropriated for State aid July 1, 1913 to July 1, 1914	400,000.00
Appropriated for State aid July 1, 1914 to July 1, 1915	700,000.00

Estimated tax levy in Illinois for roads and bridges, $7,000,000; of which about 40 per cent is used for bridges.

A. N. Johnson,
State Highway Engineer.

Note: State expenditures fiscal year 1913—$100,000.—*From U. S. Office Public Roads.*

Indiana

Local expenditures 1912—$8,887,553. Highway and bridge bonds voted 1913—$4,705,797.—*From U. S. Office of Public Roads.*

Iowa

Estimated amount of money available for road improvement during 1914, including culverts and bridges

State appropriation for highway commission	$60,000.00
Auto tax distributed by the State	750,000.00
Twp. road fund controlled by twp. trustees	2,500,000.00
Twp. drag fund controlled by twp. trustees	500,000.00
County road fund controlled by county supervisor	1,000,000.00
County bridge fund controlled by county supervisors	3,500,000.00
	$7,310,000.00

The above are all cash taxes. There is in addition roughly $500,000 available from labor taxes.

THOS. H. MCDONALD,
Highway Engineer.

Kansas

Expenditures 1913:

Township and county funds for roads and bridges	$4,800,000.00
Automobile and motor cycle registration fees	175,000.00
For State highway work, a little more than	9,000.00

W. S. GEARHART,
State Engineer.

NOTE: Local expenditures 1912—$5,155,360.—*From U. S. Office Public Roads.*

Kentucky

Total appropriation for State highway department for 1913 was $25,000. The total appropriation for 1914 is $25,000, but only such part to be used as is necessary in carrying on the work of the department, which is purely advisory. Estimated money to be spent by the various counties on the public roads during 1914—$2,000,000.

ROBERT C. TERRELL,
Commissioner of Public Roads.

NOTE: Local expenditures 1912—$1,933,000 plus about 555,000 days statute labor worked out.—*From U. S. Office Public Roads.*

Louisiana

Total expenditures for State aid roads up to December 31, 1911, $129,594.16; State appropriation for State aid for the year 1912, $130,000; total expenditure for State aid roads up to December 31, 1913:

State funds	$71,067.60
Parish funds	156,504.00
Total	$227,571.60

These amounts are supplemented by labor of State convicts, surplus revenues of the oyster commission and the fish and game commission and automobile revenues. The cost of State aid roads is apportioned 20 to 50 per cent to the State and 50 to 80 per cent to the county.

Estimated parish expenditures for 1913, $2,500,000; estimated expenditures by incorporated places $2,200,000; State highway department contracts let during 1913, $280,684.32; State convict camps 1912, $32,220.

C. C. Sandoz,
Secretary, Highway Department, Board of State Engineers.

Maine

During the year 1914 there will be available for expenditure for the State highway department the following sum:

State highways	
From sale of highway bonds, September 1, 1913.....	$300,000.00
State highway bonds to be issued during 1914.......	500,000.00
Total for state highway construction..............	$800,000.00
State aid highways	
State aid appropriations............................	$300,000.00
From cities and towns for same purpose, about.....	300,000.00
Total for state aid construction....................	$600,000.00
Administration and Maintenance	
State appropriation....................................	$50,000.00
Residue from automobile licenses fees after payment of interest and sinking funds on bonds (estimated)..	75,000.00
Payments by towns on account of maintenance State aid highways already built (estimated)..........	15,000.00
Total for administration and maintenance........	$140,000.00
Total appropriation to be handled by State highway department for 1914.....................	$1,540,000.00

I should estimate that the cities and towns on their own account, entirely separate and apart from the above expenditures would expend, $1,500,000.

Paul D. Sargent,
Chief Engineer.

Maryland

State expenditures 1913—$2,500,435.—*From State Report.*

Local expenditures 1912—$1,000,000.—*From U. S. Office of Public Roads.*

For 1914, as follows:

State aid	$300,000
Maintenance	400,000
State roads (recommended)	3,000,000
	$3,700,000

Massachusetts

The cities and towns in Massachusetts expended last year about $8,232,490 for highways, and also an excise and franchise tax available from street railway companies amounting to $1,327,191, making a total of $9,559,681. They will have as much or more in 1914.

These expenditures were outside of the expenditures that were made by the State for State highways, etc. Our department expended in 1913 for new construction, including State highways, "small town" work, and work under the motor vehicle fees act, $1,034,902. We had available under special acts $338,375, and for two investigations $869, making a total of about $1,374,147. We expended for maintenance, bridges, etc., $819,854.47, and for general office expenditures $62,561.77. We also have the automobile department, which adds for investigations, registrations, etc., $128,420.83, making a total of $2,384,984.97.

Expenditures 1912 by cities and towns

Total expenditures for highway purposes	$7,739,764.67
Of this amount the reports show that	
Construction and resurfacing cost	3,431,402.70
Bridges and culverts	970,315.54
General expense, repairs and maintenance	3,338,046.43
	$7,739,764.67
These expenditures (expended by the Massachusetts Highway Commission) do not include about	2,500,000.00
Total expenditures	$10,239,764.67

For 1914 we have available from the loan fund for State highway work and "small town" work from the road fund, $1,000,000; for work in the towns under "motor vehicle fees," probably $150,000; bridges, $20,000; for the repair of State highways from the tax levy, probably $350,000; and from motor vehicle fees probably $550,000. We also have available from special acts for particular roads $352,315, making a total of $2,447,315 to be expended by this department.

Wm. D. Sohier,
Chairman, Massachusetts Highway Commission.

Michigan

There were appropriated by the last legislature $700,000 for the fiscal year 1914, to be used for the running expenses of this department and for the payment of State rewards upon roads. In addition to this, all automobile license fees are to be turned over to this department to be applied in the building and improvement of highways.

For the fiscal year ending June 30, 1913, this department paid out $329,392 in State rewards upon roads.

According to statistics compiled in this office, it is estimated that about $4,183,972 will be raised for roads purposes by townships and counties, by bonding and direct taxation.

FRANK F. ROGERS,
State Highway Commissioner.

Minnesota

The following funds are available for road work in Minnesota for 1914:

State aid fund	$1,400,000
County road fund	1,874,291
Township road fund	2,397,963
Total	$5,672,254

GEORGE W. COOLEY,
State Engineer.

NOTE: Local expenditure 1912, $3,000,000—*From U. S. Office Public Roads.*

Mississippi

I am enclosing a list of the bond issues that have been made and that are available for 1914. There may be some errors as I got this information from indirect sources owing to the short time that I had:

Alcorn County $50,000, Attala County $175,000, Clay County $15,000, Covington County $20,000, Greene County $50,000, Jones County $150,000, Lauderdale County $200,000, Benton County $20,000, Copiah County $25,000, Jackson County $3,000, Lee County $40,000, Leflore County $40,000, Lincoln County $10,000, Noxubee County $99,000, Pike County $200,000, Rankin County $75,000, Warren County $303,100, Wayne County $100,000, Union County $35,000.

Pike County issue did not become available until this year, also part of Lauderdale, Copiah, Jones, Warren, etc.

This totals $1,720,000 but I have no doubt, but that the $2,500,000 mark and possibly the $3,000,000 mark will be reached this year.

A. T. WITBECK, C.E.

NOTE: Local expenditures, 1912—$2,000,000.

Missouri

State highway commission, appropriation 1913-14—$16,000. State funds apportioned to counties 1913—$321,730. County expenditures 1912—$4,650,516.

State funds available 1914 in giving aid to counties from four sources; stamp act, automobile registration, corporation tax and general State road fund.—*From U. S. Office Public Roads.*

Montana

The State proper will not spend any money for highway improvement during the year of 1914, owing to the fact that no appropriation was made at the last legislature for such purposes.

The road fund available and raised by taxes levied in the various counties will amount to about $2,000,000. In addition to this there will be a small amount, some $60,000 or $80,000 derived from the rental of forest reserves and appropriated by the U. S. Forest Service to the counties in which such revenue is derived.

As to an estimate of the expenditures which will be made by the counties during 1914 for road purposes I have no detailed figure at this time.

The year 1912 expended for road purposes $1,058,341 and for bridge purposes $474,446 within the State.

GEO. R. METLEN,
Secretary, Board of Highway Commissioners.

NOTE: State expenditure 1913, $2484.—*From U. S. Office Public Roads.*

Nebraska

A State tax of one-fifth of 1 mill is levied to create a State aid bridge fund, which for 1914 amounts approximately $90,000.

I am not in shape to advise you the different amounts of money that the counties and township organizations will raise.

D. D. PRICE,
State Engineer.

NOTE: State expenditures 1913, $52,428. Local expenditure, 1912, $2,278,188.—*From U. S. Office Public Roads.*

Nevada

There are no State funds available, but certain bond issues have been made by various counties for road work, the amounts of which I cannot give you at this date.

W. M. Kearney,
State Engineer.

Note: 1912 expenditure, $150,000.—*From U. S. Office Public Roads.*

New Hampshire

There will be expended during 1914 approximately $500,000 for construction and $125,000 for maintenance.

The total expenditures for State aid up to January 15, 1914, has been $1,804,310.94. The State's portion for the year ending January 15, 1914, was trunk line roads $194,900.80; for State aid roads $82,650.88; for State roads $35,471.07. There was expended for maintenance $109,660.57 during the same period by the State.

S. Percy Hooker,
State Superintendent of Highways.

New Jersey

It is impossible to give you the exact information as to the road funds available during the year 1914 until the legislature has acted in the matter of appropriations.

The motor vehicle fund is estimated to yield from $600,000 to $650,000 for road work (of this about $210,000 has been already collected and spent). It is now proposed to change the scale of motor vehicle fees, which might affect this amount very considerably. In addition to this the legislature will probably make some appropriation. Preliminary estimates submitted to them request an additional appropriation of about $300,000 available for road work. The additional amount usually appropriated for this purpose in the past has been $100,000. To avoid misunderstanding I summarize as follows:

Regular appropriation for the year ending October 31, 1914, $450,000. Estimated motor vehicle receipts available for roads, $640,000. Supplementary appropriation requested, $300,000 which is in addition to the $450,000 appropriated by the last legislature, making the total for the road fund $750,000 exclusive of the motor vehicle receipts.

E. A. Stevens,
Commissioner.

Note: Expenditures fiscal year 1913 State highway department:

Construction	$532,725
Maintenance (from motor vehicle fund)	323,807
Administration, etc	77,558
Total	$934,090

Local expenditures 1912—$3,629,773.—*From U. S. Office Public Roads.*

New Mexico

The total amount of money available for road and bridge purposes in the State of New Mexico during the second fiscal year to November 30, 1914, is as follows:

To be spent by highway commission		
Mill levy	$82,000	
Automobile licenses	10,000	
Forest reserve	6,246	
Special roads (county levy)	22,210	
	$120,456	$120,456
To be spent by counties		
General road and bridge fund	$167,745	
Special Bridges	65,675	
Camino Real	23,922	
Forest reserve	9,396	
	$266,738	$266,738
Total		$387,194

Of this amount $65,675 must be used in paying for bridges built or being built under contracts already made.

Leaving $321,519 available for new work.

The total amount expended for roads and bridges during the calendar year 1913 was $302,912.67.

James A. French,
State Engineer.

New York

I beg to advise that the appropriation for 1914 has not yet been made by the legislature. This department has, however, an unobligated balance of unexpended appropriations amounting to approximately $6,000,000, which will be available for construction in 1914, about $3,000,000 of this being appropriated from the first referendum or bond issue and about $3,000,000 having been appropriated from the second referendum or bond issue. There will also be approximately $3,600,000 appropriated by the State and counties in equal proportion to be expended on the maintenance and repair of what are called town roads in distinction from improved roads, the improved roads being those which have been constructed either wholly or in part from the highway improvement fund. This money is not expended by the department but under its supervision. The bureau of town highways having charge of that work.

No appropriation has been made yet by the legislature for the maintenance and repair of roads during 1914, but in all probability this appropriation will approximate $3,500,000.

S. D. GELBRICH,
Auditor.

NOTE: Local expenditures 1912—$6,938,694.—*From U. S. Office Public Roads.*

North Carolina

Funds available for 1914

Amount of bonds voted in 1913 for road work..........	$3,642,500
Special tax for road purposes (a portion of this goes toward defraying interest and sinking fund on bonds.	$1,061,500
Average number of county convicts used on roads (for 1913)..	1,700
Number of state convicts on public roads (for 1913)....	144

JOSEPH HYDE PRATT,
State Geologist.

North Dakota

I am of the opinion that approximately $725,000 will be collected by the various counties of the State as taxes for the road and bridge fund. There will be paid into the county treasuries in the neighborhood of $400,000 in the way of delinquent taxes, in addition to the amount mentioned. There will be approximately $40,000 returned to the various counties from the motor vehicle registration account. There are no funds to be expended under the direction of this office for road purposes.

It is difficult to estimate the amount of money that will be expended in the various townships during the ensuing year, because of the fact that there are no past records to go by. I estimate however, that at least $1,200,000 worth of township taxes will be worked out in the various townships in the State. This is in addition to the estimates given in the previous paragraph.

Practically the entire amount of money raised during the year for road purposes will be expended in 1914, therefore the total amount of money expended on North Dakota roads in the year 1914 is approximately $2,365,000.

As above stated, there are no road funds to be expended under the direction of the State engineer and no State levy or appropriation for this purpose.

JAY W. BLISS,
State Engineer.

Ohio

There will be available for State aid in road building a levy of one-half of 1 mill which will amount to approximately $3,500,000. One-fourth of this amount is to be set aside for the construction of main market roads and may be spent independent by the State highway department. The remaining three-fourths is to be used in coöperation with the county, the county being required to furnish an amount at least equal to the amount provided by the State. It is the intention to use the proceeds of the automobile license money for road maintenance and repair.

JAMES R. MARKER,
State Highway Commissioner.

NOTE: Expenditures State highway department 1913—$738,174. County and township expenditures 1912—$7,350,000.—*From U. S. Office Public Roads.*

Oklahoma

Local expenditures 1912—$4,105,300. Highway and bridge bonds voted 1913—$82,288. State highway commission, administration—$5,000. *From U. S. Office Public Roads.*

Oregon

Expenditure State highway commission 1913—$5008. State funds available 1914—$238,000. Local funds available 1914—$3,288,000.—*From U. S. Office Public Roads.*

The expenditures in Oregon for roads and bridges during the year 1913 approximated $3,288,000. It is probable that during 1914 more than $4,000,000 will be expended.

H. L. BOWLBY,
State Highway Engineer.

Pennsylvania

Approximate funds available from January 1, 1914, to June 1, 1915

State highways, State-aid highways, national road and maintenance funds	$2,000,000
Automobile division expenses, experiments and tests, contingent funds, etc	300,000
Township road fund	245,000

In addition to the above funds, the department will have available about $1,000,000 from township and county funds, being the shares returned by counties and townships on State-aid roads.

JOHN T. GEPHART, JR.,
Acting Chief Engineer.

Rhode Island

Total expenditures on trunk lines for construction to December 31, 1913—$2,620,784.40. For reconstruction, resurfacing and repairs from 1905 to December 31, 1913—$883,282.41.

Do not expect any appropriation for construction this year.

The State board of public roads, asked the legislature for an appropriation of $250,000, for maintenance only.

The income from the automobile law will be about $140,000 this year.

All the towns of this State appropriate for their highways about $390,000 collectively each year.

PETER J. LANNON,
Clerk.

NOTE: State expenditure for 1913.

Construction	$279,733
Maintenance	260,864
	$540,597

Local expenditures 1912—$281,775.—*From U. S. Office Public Roads.*

South Carolina

The counties in this State spend annually a sum aggregating just about $1,000,000 for road work, and we use convicts entirely in the construction of highways. Under our present law even life term men can be used on the highways when they are not considered dangerous by the authorities.

E. J. WATSON,
Commissioner of Agriculture.

South Dakota

Fifty-three counties levied $561,622 last September for expenditure in 1914. Also the townships of the State levied about as much making $1,000,000 in all. The road movement in the past has not been prominent but is gaining rapidly now. Great progress will be made this year.

E. C. ISSENHUTH,
Chairman, State Highway Commission.

NOTE: County and township road and bridge expenditures 1912, $1,250,000.—*From U. S. Office Public Roads.*

Tennessee

Local expenditures 1912—$2,000,000. Highway and bridge bonds voted 1913.—$2,766,000.—*From U. S. Office Public Roads.*

Texas

Local expenditures 1912—$7,269,592. Highway and bridge bonds voted 1913—$6,598,819.—*From U. S. Office Public Roads.*

Utah

State funds available 1913–14—$97,200. Local expenditure 1912—$500,000.—*From U. S. Office Public Roads.*

Vermont

State appropriation for 1914	$200,000
Voted by towns to get State aid	125,000
Five per cent tax apportionment	110,000
	$435,000

We may easily say, in round numbers, that the road expenditures for 1914 (construction) will be $450,000.

For maintenance of the State roads only, there will be

Expended by the State an estimate of	$100,000
Expended by the towns, a minimum	100,000
	$200,000

M. Sheed,
Clerk, State Highway Commission.

Note: State expenditure 1913—$505,000. Local expenditure 1912, $676,039.—*From U. S. Office Public Roads.*

Virginia

We are asking the present legislature for a total of $463,000, and we feel satisfied that this will be about the amount appropriated for the coming year. We will also have the expending of about $1,500,000 from the different district and county bond issues. Of course it will be impossible for us to expend during the year 1914, under existing conditions, as much as $2,000,000 but we will probably expend $1,500,000.

We constructed approximately 619 miles of road at a cost of $1,411,000 and 83 bridges at a cost of $112,000.

Geo. P. Coleman,
State Highway Commissioner.

Washington

The amount of the State levies for 1913, available for road work in 1914, is $2,789,806.

Wm. R. Roy,
Highway Commissioner.

Local expenditures 1912—$4,059,509.—*From U. S. Office Public Roads.*

West Virginia

We will expend approximately in this State on roads $2,268,557.92 in 1914. We do not have the information as to expenditures for 1913.

L. W. Stenger,
Clerk, State Road Bureau.

Note: Local expenditures 1912—$1,042,353.—*From U. S. Office Public Roads.*

Wisconsin

State funds available 1914—$1,230,000 for State aid and $95,000 for administration.

State expenditures 1913—$1,305,000. Local expenditures 1912—$4,000,000.—*From U. S. Office Public Roads.*

Wyoming

The only State appropriation for road work was that made by the last Legislature, amounting to $7500 for the purchase of tools and equipment necessary in using convicts on State highways. Probably half of this amount is available for use during 1914. It is estimated that the counties of the State will spend $500,000 during 1914.

A. J. Parshall,
State Engineer.

APPROXIMATE PUBLIC ROAD EXPENDITURES BY STATES, COUNTIES, AND TOWNSHIPS DURING CALENDAR YEAR 1913

Returns are not available, except in a few States, covering local expenditures during 1913. The following table shows therefore, in most of the States, local expenditures for 1912 and State expenditures for 1913. It would seem conservative to add to the total as shown by the table about 8 per cent, thus allowing an increase of about 10 per cent in local expenditures in 1913 as compared with 1912 expenditures. Where the year is not stated in the table the figures are for the calendar year 1913.

Alabama	State	$264,000	
	Local	1,900,000	$2,164,000
Arizona	State	274,631	
	Local	335,724	610,355
Arkansas	(1912)	1,586,050	1,586,050
California	State	2,032,084	
	Local (1912)	6,228,527	8,260,611
Colorado	State	448,000	
	Local (1912)	1,469,690	1,917,690
Connecticut	State (about)	1,850,000	
	Local (1912)	1,250,000	3,100,000
Delaware	State	10,000	
	Local (1912)	339,000	349,000
Florida	Local (1912)	1,500,000	1,500,000
Georgia	Local (1912)	2,750,000	2,750,000
Idaho	State	15,000	
	Local	1,000,000	1,015,000
Illinois	State	100,000	
	Local	7,000,000	7,100,000
Indiana	Local (1912)	8,887,553	8,887,553
Iowa	State (1914)	60,000	
	Local (1914)	7,250,000	7,310,000
Kansas	State (1914)	9,000	
	Local (1914)	4,975,000	4,984,000
Kentucky	State	25,000	
	Local	2,000,000	2,025,000
Louisiana	State	71,000	
	Local	2,500,000	2,571,000
Maine	State	496,000	
	Local	1,800,000	2,296,000
Maryland	State	2,500,435	
	Local (1912)	1,000,000	3,500,435
Massachusetts	State	2,384,984	
	Local	8,232,490	10,617,474
Michigan	State	329,392	
	Local (1914)	4,183,972	4,513,364

Minnesota	State (1914)	1,400,000	
	Local (1914)	4,272,254	5,672,254
Mississippi	Local (1912)	2,000,000	2,000,000
Missouri	State	329,000	
	Local (1912)	4,650,516	4,979,516
Montana	State	2,484	
	Local (1912)	1,532,787	1,535,271
Nebraska	State	52,428	
	Local (1912)	2,278,188	2,330,616
Nevada	1912	150,000	150,000
New Hampshire	Joint expenditures	752,059	752,059
New Jersey	State	934,090	
	Local (1912)	3,629,773	4,563,863
New Mexico	1914	387,194	387,194
New York	State (estimated)	10,000,000	
	Local (1912)	6,938,694	16,938,694
North Carolina	Exclusive of bonds	1,061,500	
	Bonds voted	3,642,500	4,704,000
North Dakota	1914	2,365,000	2,365,000
Ohio	State	738,174	
	Local (1912)	7,350,000	8,088,174
Oklahoma	State	5,000	
	Local (1912)	4,105,300	4,110,300
Oregon	State	5,008	
	Local (1912)	3,288,000	3,293,008
Pennsylvania	State 1914 (about)	1,800,000	
	Local contribution	1,000,000	
	Local (1912)	5,864,718	8,664,718
Rhode Island	State	540,597	
	Local (about)	390,000	930,597
South Carolina	Estimated	1,000,000	1,000,000
South Dakota	Local (1912)	1,250,000	1,250,000
Tennessee	Local (1912)	2,000,000	2,000,000
Texas	Local (1912)	7,269,592	7,269,592
Utah	State	97,200	
	Local (1912)	500,000	597,200
Vermont	State	505,000	
	Local (1912)	676,039	1,181,039
Virginia	State	250,000	
	Local	1,978,590	2,228,590
Washington	State (1914)	1,250,000	
	Local (1912)	4,059,509	5,309,509
West Virginia	Local (1914)	2,268,557	2,268,557
Wisconsin	State	1,305,000	
	Local (1912)	4,000,000	5,305,000
Wyoming	State	7,500	
	Local (1914)	500,000	507,500
Total			$177,537,783
Add 8 per cent for increase in local expenditures 1913 over 1912			14,202,000
Total			$191,739,783
Value of statute labor estimated by U. S. Office of Public Roads			15,000,000
Total			$206,739,783

Of the above amount approximately $29,600,000 consisted of State funds expended under the State highway departments. The total expenditure of State funds for road construction and maintenance, all years to December 31, 1913, was approximately $155,000,000.

STATE HIGHWAY DEPARTMENT FUNDS AVAILABLE FOR 1914

Alabama	$267,165.00
Arizona	258,577.00
Arkansas	25,000.00
California (estimated expenditures)	5,000,000.00
Colorado	375,000.00
Connecticut	1,850,000.00
Delaware	10,000.00
Idaho	275,000.00
Illinois	600,000.00
Iowa	60,000.00
Kansas	9,000.00
Kentucky	25,000.00
Louisiana	140,000.00
Maine	1,225,000.00
Maryland	3,700,000.00
Massachusetts	2,447,315.00
Michigan	1,070,000.00
Minnesota	1,400,000.00
Missouri	337,000.00*
Nebraska (bridges)	90,000.00
New Hampshire	625,000.00†
New Jersey	1,390,000.00
New Mexico	120,456.00
New York	11,300,000.00
North Carolina	7,000.00
Ohio	4,000,000.00
Oklahoma	5,000.00
Oregon	238,000.00
Pennsylvania	2,800,000.00
Rhode Island	390,000.00
Utah	97,200.00
Vermont	410,000.00
Virginia (recommended)	463,000.00
Washington	1,250,000.00
West Virginia	5,000.00
Wisconsin	1,325,000.00
Wyoming	3,750.00
Total	$43,858,463.00

* Based on 1913 figures.
† Includes some local funds.

PATENTS ISSUED BY UNITED STATES PATENT OFFICE IN 1913 PERTAINING TO ROADS

1,049,387. *Elevator-drag*. Alonso T. Adams, of Moline, Illinois, assignor to Marseilles Company, of East Moline, Illinois, a corporation of Illinois. Continuation of application Serial No. 485,640 filed March 25, 1909. This application filed April 29, 1912. Serial No. 693,920. Patented Jan. 7, 1913.

1,049,428. *Lift-bridge*. John A. L. Waddell and John Lyle Harrington, of Kansas City, Missouri. Filed November 20, 1911. Serial No. 661,282. Patented January 7, 1913.

1,049,542. *Corrugated metal casing for culverts, drainage-tiling, etc.* Andrew Smith, of San Mateo, California, assignor to Smith Metal Perforating Company, of San Mateo, California. Filed April 9, 1912. Serial No. 689,594. Patented January 7, 1913.

1,049,543. *Corrugated sheet-metal sectional casing for culverts, drainage-casings, etc.* Andrew Smith of San Mateo, assignor, to Smith Metal Perforating Company, of San Mateo, California. Filed April 13, 1912. Serial No. 690,519. Patented January 7, 1913.

1,049,544. *Sheet-metal casing for culverts, conduits, and drainage tiling.* Andrew Smith, of San Mateo, California, assignor, to Smith Metal Perforating Company, of San Mateo, California. Filed April 13, 1912. Serial No. 690,520. Patented January 7, 1913.

1,049,744. *Road drag*. William C. Maggard, of Mingo, Iowa. Filed April 15, 1912. Serial No. 690,842. Patented January 7, 1913.

1,049,774. *Rotary under-reamer*. Albert J. Snow and Archie M. Kidd, of Taft, California. Filed September 28, 1912. Serial No. 722,871. Patented January 7, 1913.

1,049,816. *Sheet-metal culvert*. John H. Dean of Birmingham, Alabama, assignor by direct and mesne assignments, to the United States Sheet and Metal Culvert Company, a corporation of Delaware. Filed April 22, 1912. Serial No. 692,326. Patented January 7, 1913.

1,049,817. *Sheet-metal culvert*. John H. Dean, of Birmingham, Alabama, assignor by direct and mesne assignments, to the United States Sheet and Metal Culvert Company, a corporation of Delaware. Filed April 30, 1912. Serial No. 694,271. Patented January 7, 1913.

1,050,003. *Road-cutter or the like*. Lee D. Craig, of San Francisco, California, assignor to National Trenching Machine Company, of Washington, District of Columbia, a corporation of Delaware. Original application filed December 14, 1909. Serial No. 533,063. Divided and this application filed May 12, 1910. Serial No. 561,005. Renewed June 12, 1912. Serial No. 703,327. Patented January 7, 1913.

1,050,055. *Sheet-metal culvert*. John H. Dean, of Birmingham, Alabama, assignor by direct and mesne assignments, to the United States Sheet and Metal Culvert Company, a corporation of Delaware. Original application filed April 22, 1912. Serial No. 692,326. Divided and this application filed September 16, 1912. Serial No. 720,527. Patented January 7, 1913.

1,050,056. *Sheet-metal culvert*. John H. Dean, of Birmingham, Alabama, assignor, by direct and mesne assignments, to the United States Sheet and Metal Culvert Company, a corporation of Delaware. Original application filed April 22, 1912, serial No. 692,326. Divided and this application filed September 16, 1912. Serial No. 720,528. Patented January 7, 1913.

1,050,398. *Rock-crusher*. Thomas L. Smith, of Milwaukee, Wisconsin. Filed October 29, 1910. Serial No. 589,778. Patented January 14, 1913.

1,050,806. *Rotator for rock-drills*. Charles T. Carnahan, of Denver, Colorado. Filed April 22, 1911. Serial No. 622,848. Patented January 21, 1913.

1,050,838. *Excavating-bucket*. George W. King, Charles B. King, Harvey T. Gracely, and Herbert E. Roush, of Marion, Ohio, assignors to the Marion Steam Shovel Company, of Marion, Ohio, a corporation of Ohio. Filed September 24, 1910. Serial No. 583,611. Patented January 21, 1913.

1,050,839. *Excavating-bucket*. George W. King, Charles B. King, Harvey T. Gracely, and Herbert E. Roush, of Marion, Ohio, assignors to the Marion Steam Shovel Company, of Marion, Ohio, a corporation of Ohio. Filed September 24, 1910. Serial No. 583,612. Patented January 21, 1913.

1,050,840. *Excavating-bucket*. George W. King, Charles B. King, Harvey T. Gracely, and Herbert E. Roush, of Marion, Ohio, assignors to the Marion Steam Shovel Company, of Marion, Ohio, a corporation of Ohio. Filed September 24, 1910. Serial No. 583,613. Patented January 21, 1913.

1,051,627. *Apparatus for producing cement*. Hermann Passow, of Hamburg, Germany, assignor by mesne assignments to the Atlas Portland Cement Company, of New York, New York, a corporation of Pennsylvania. Filed January 6, 1903. Serial No. 138,060. Patented January 28, 1913.

1,051,844. *Apparatus for producing cement*. Hermann Passow, of Blankanese, Germany, assignor, by mesne assignments, to the Atlas Portland Cement Company, of New York, New York, a corporation of Pennsylvania. Original application filed January 6, 1903, Serial No. 138-060. Divided and this application filed March 24, 1909. Serial No. 485,376. Patented January 28, 1913.

1,052,025. *Oil-sprinkling apparatus*. Howell Topping, of Brooklyn, New York. Filed March 9, 1909. Serial No. 482,260. Patented February 4, 1913.

1,052,048. *Bridge construction*. Howard Friend, of Lexington, Oklahoma. Filed May 19, 1909. Serial No. 496, 987. Patented February 4, 1913.

1,052,198. *Culvert-pipe*. Harry D. Wyre, of Orrville, Ohio. Filed November 29, 1912. Serial No. 734,045. Patented February 4, 1913.

1,052,373. *Rock-drill*. Alexander Palmros, of Syracuse, New York, assignor to the Pneumelectric Machine Company, of Syracuse, New York, a corporation of New York. Filed April 6, 1908. Serial No. 425,483. Patented February 4, 1913.

1,052,502. *Road-scraper*. Perry Miller, of Yorktown, Indiana. Filed October 28, 1911. Serial No. 657,329. Patented February 11, 1913.

1,052,578. *Joint-filling machine*. Thomas Fitzgerald, of Fredonia, New York. Filed October 10, 1910. Serial No. 586,147. Patented Febary 11, 1913.

1,052,643. *Combined roller and tractor*. Alphonse Baechle, of Norwalk, Ohio. Filed April 30, 1912. Serial No. 604,163. Patented February 11, 1913.

1,052,971. Bridge. Salvatore Sanna, of Olinghouse, Nevada. Filed June 24, 1911. Serial No. 635,151. Patented February 11, 1913.

1,053,134. Culvert and culvert-pipe. Frank B. Zieg, of Fredericktown. Ohio, assignor to the F. B. Zieg Manufacturing Company, of Fredericktown, Ohio. Filed October 26, 1912. Serial No. 727,932. Patented February 11, 1913.

1,053,208. Grading and ditching machine. William H. Morenus, of Lake View, Iowa, assignor to Austin Manufacturing Company, of Chicago, Illinois, a corporation of Illinois. Filed April 6, 1911. Serial No. 619,198. Patented February 18, 1913.

1,053,280. Rock-crushing machinery. Jean Ribeyron, of Sosnowice, Russia. Filed December 27, 1911. Serial No. 668,125. Patented February 18, 1913.

1,053,426. Scraper. William H. Morris, of Brownsville, Tennessee, assignor, by direct and mesne assignments, of one-third to Edgar S. Harston and one-third to William H. Coffey, both of Brownsville, Tennessee. Filed May 13, 1912. Serial No. 697,064. Patented February 18, 1913.

1,053,428. Excavating-machine. Claude E. Negley, of Indianapolis, Indiana. Filed May 6, 1912. Serial No. 695,550. Patented February 18, 1913.

1,053,475. Bevel-cutting dies for rock-drills. Carl Brown, of Denver, Colorado, assignor to the Champion Forging Machine Company, of Denver, Colorado, a corporation of Colorado. Filed August 2, 1909. Serial No. 510,951. Patented February 18, 1913.

1,053,476. Sharpening-dies for rock-drills. Carl Brown, of Denver, Colorado, assignor to the Champion Forging Machine Company, of Denver, Colorado, a corporation of Colorado. Filed August 2, 1909. Serial No. 510,952. Patented February 18, 1913.

1,053,545. Bridge-crane. Edwin H. Steedman, of St. Louis, Missouri. Filed November 22, 1912. Serial No. 732,839. Patented February 18, 1913.

1,054,065. Road-drag. Warren C. Wharton, of Fremont, Iowa. Filed September 16, 1912. Serial No. 720,660. Patented February 25, 1913.

1,054,123. Rock-crusher. Charles T. Hutchinson, of Oakland, California, assignor to Joshua Hendry Iron Works, of San Francisco, California, a corporation of California. Filed June 8, 1911. Serial No. 632,078. Patented February 25,1913.

1,054,181. Percussive Rock-drill. Carl Davenport, of Sheffield, England, assignor of one-half to Richard Nicholson, of Sheffield, England. Filed July 15, 1911. Serial No. 638,620. Patented February 25, 1913.

1,054,483. Grading-machine. Andrew J. Akers and Emmett E. Akers, of Columbus, Illinois, Filed May 20, 1912. Serial No. 698, 543. Patented February 25, 1913.

1,054,895. Culvert. Gardner A. Balknap, of Conneautville, Pennsylvania. Filed October 31, 1912. Serial No. 728,955. Patented March 4, 1913.

1,055,380. Culvert-mold. Byron E. Woodhull, of Webster, and William A. Wilson, of Lockport, New York. Filed July 1, 1911. Serial No. 636,487. Patented March 11, 1913.

1,055,635. Traction-engine. Henry J. Heider, of Carroll, Iowa, assignor to Heider Manufacturing Company, of Carroll, Iowa. Filed February 20, 1911. Serial No. 609,681. Patented March 11, 1913.

1,055,674. Sheet-metal casing for drainage culverts, conduits, screens, wells, etc. Andrew Smith, of San Mateo, California, assignor to Smith Metal Perforating Company, of San Mateo, California. Filed March 16, 1912. Serial No. 684,177. Patented March 11, 1913.

1,055,806. Culvert. Julius H. Schlafly, of Canton, Ohio, assignor to the Canton Culvert Company, of Canton, Ohio, a corporation of Ohio. Filed April 29, 1908. Serial No. 429,847. Patented March 11, 1913.

1,055,882. Collapsible form for building culverts. Charles A. Besser, of Mount Pleasant, Iowa. Filed August 17, 1911. Serial No. 644,617. Patented March 11, 1913.

1,056,105. Excavating-machine. Leo A. Krupp, of Findlay, Ohio. Filed February 5, 1912. Serial No. 675,686. Patented March 18, 1913.

1,056,132. Rock-drill. Nikolaus Staub, of Schiffweiler, Germany. Filed May 5, 1911. Serial No. 625,307. Patented March 18, 1913.

1,056,268. Excavating apparatus. James G. Fairbanks, of Marion, Ohio. Filed December 6, 1909. Serial No. 531,644. Patented March 18, 1913.

1,056,398. Excavating-machine. Chalmers S. Brown, and Frank H. Gerdeman, of Findlay, Ohio, assignors to the Buckeye Traction Ditcher Company, of Findlay, Ohio, a corporation of Ohio. Filed February 1, 1912. Serial No. 674,778. Patented March 18, 1913.

1,056,935. Roadway for vehicles. Frederick L. Pitman, of Spokane, Washington. Filed May 1, 1912. Serial No. 694,520. Patented March 25, 1913.

1,057,162. Wheeled excavator or ditching-machine. Daniel H. Mahoney, of Vincennes, Indiana, assignor to the Mahoney Railroad Ditching Machine Company, of Vincennes, Indiana. Filed November 5, 1910. Serial No. 590,894. Patented March 25, 1913.

1,057,227. Treating petroleum and petroleum residues. Jesse A. Dubbs, of Los Angeles, California. Filed December 5, 1910. Serial No. 595,750. Patented March 25, 1913.

1,057,253. Squeegee. Frank J. Matchette, of Milwaukee, Wisconsin. Filed December 17, 1908. Serial No. 467,991. Patented March 25, 1913.

1,057,416. Process of concentrating sulfite waste liquor. Carleton Ellis, of Montclair, New Jersey, assignor to Ellis-Foster Company, a corporation of New Jersey. Filed February 16, 1912. Serial No. 678,153. Patented April 1, 1913.

1,057,457. Excavating-machine. Charles W. Rood, of Grand Rapids, Wisconsin. Filed August 15, 1910. Serial No. 577, 169. Patented April 1, 1913.

1,057,505. Sheet-metal casing for culverts, conduits, etc. Andrew Smith, of San Mateo, California, assignor to Smith Metal Perforating Company, of San Mateo, California. Filed July 24, 1912. Serial No. 711,271. Patented April 1, 1913.

1,057,732. Rock-drill. Charles C. Hansen, of Easton, Pennsylvania, assignor to Ingersoll-Rand Company, of New York, New York, a corporation of New Jersey. Filed August 8, 1911. Serial No. 643,006. Patented April 1, 1913.

1,057,733. Rock-drill. Charles C. Hansen, of Easton, Pennsylvania, assignor to Ingersoll-Rand Company, of New York, New York, a corporation of New Jersey. Filed August 8, 1911. Serial No. 643,007. Patented April 1, 1913.

1,057,922. Rock-drill. Julian E. Blackburn, of Texarkana, Texas. Filed July 17, 1912. Serial No. 710,073. Patented April 1, 1913.

1,057,997. Support for bridge-planks. Fred L. Doeblin, of Rush Hill, Missouri. Filed May 14, 1912. Serial No. 697,264. Patented April 1, 1913.

1,058,072. Rock-drilling engine. John George Leyner, of Denver, Colorado, assignor to the J. Geo. Leyner Engineering Works Companys, of Littleton, Colorado, a corporation of Colorado. Filed July 5, 1910. Serial No. 570,339. Patented April 8, 1913.

1,058,073. Water-conveying apparatus for ejecting rock-drillings for rock-drilling engines. John George Leyner, of Denver, Colorado, Filed August 15, 1911. Serial No. 644,151. Patented April 8, 1913.

1,058,198. *Culvert*. Julius H. Schlafly, of Canton, Ohio, assignor to the Canton Culvert Company, of Canton, Ohio, a corporation of Ohio. Filed October 28, 1911. Serial No. 657,271. Patented April 8, 1913.

1,058,490. *Road-surfacing machine*. William H. Gailor, of Saratoga Springs, New York. Filed September 20, 1912. Serial No. 721,418. Patented April 8, 1913.

1,058,503. *Road surface and preservative*. Henry R. Wardwell, of New York, New York, assignor to H. W. Johns-Manville Company, a corporation of New York. Filed July 16, 1912. Serial No. 709,790. Patented April 8, 1913.

1,058,526. *Culvert-mold*. Alfred Bailey, of Aredale, Iowa. Filed November 20, 1911. Serial No. 661,219. Patented April 8, 1913.

1,058,841. *Scarifying attachment for road-machines*. David C. Boyd, of Galion, Ohio. Filed June 4, 1912. Serial No. 701,671. Patented April 15, 1913.

1,059,227. *Excavating attachment for motor-vehicles*. Dudley Smith, of Benton, Illinois, Filed May 3, 1912. Serial No. 694,950. Patented April 15, 1913.

1,060,558. *Excavator*. Willard L. Reed, of Washington, Pennsylvania. Filed June 8, 1912. Serial No. 702,522. Patented April 29, 1913.

1,060,604. *Road-making machine*. Charles F. Keables, of Indianola, Iowa. Filed May 6, 1912. Serial No. 695,560. Patented May 6, 1913.

1,060,684. *Traction device*. John S. Hunter, of Egeland, North Dakota. Filed March 25, 1912. Serial No. 686,186. Patented May 6, 1913.

1,060,917. *Arch*. Daniel B. Luten, of Indianapolis, Indiana. Filed April 24, 1905. Serial No. 257,165. Patented May 6, 1913.

1,060,918. *Arch*. Daniel B. Luten, of Indianapolis, Indiana. Filed April 24, 1905. Serial No. 257,166. Patented May 6, 1913.

1,060,920. *Concrete bridge*. Daniel B. Luten, of Indianapolis, Indiana. Original application filed November 1, 1906, serial No. 341,605. Divided and this application filed March 29, 1909. Serial No. 486,643. Patented May 6, 1913.

1,060,921. *Concrete bridge*. Daniel B. Luten, of Indianapolis, Indiana. Original application filed November 1, 1906, serial No. 341,605, Divided and this application filed March 29, 1909. Serial No. 486,645. Patented May 6, 1913.

1,061,085. *Combined scraper and smoother*. Frank J. Kolson, of McKeesport, Pennsylvania. Filed February 17, 1913. Serial No. 748,976. Patented May 6, 1913.

1,061,104. *Traction-engine*. Fred H. Nett, and Frank W. Nett, of Rialto, California. Filed September 20, 1911. Serial No. 650,328. Patented May 6, 1913.

1,061,144. *Grading-scraper*. James F. Thomas and John Haney, of Odessa, Minnesota. Filed December 13, 1912. Serial No. 736,510. Patented May 6, 1913.

1,061,210. *Chambering attachment for rock-drills*. John B. Word, of Latrobe, California, assignor of one-half to William F. Deaner, of Amador City California. Filed April 5, 1912. Serial No. 688,589. Patented May 6, 1913.

1,061,296. *Wood-pavement*. Harry G. Jennison, of Toledo, Ohio. Filed April 17, 1912. Serial No. 691,439. Patented May 13, 1913.

1,061,453. *Traction-engine*. Oscar McGruder Cox, of Plainview, Texas. Filed May 4, 1910. Serial No. 559,279. Patented May 13, 1913.

1,061,491. *Culvert-mold*. John F. Peck, of Madison, South Dakota. Filed October 21, 1911. Serial No. 655,972, Patented May 13, 1913.

1,061,684. *Traction-engine*. Nels H. Nelson, of Willmar, Minnesota. Filed November 6, 1911. Serial No. 658,768. Patented May 13, 1913.

1,061,788. Rotating Mechanism for rock-drills. Clark J. Smith, of Ottumwa, Iowa, assignor to the Hardsogg Wonder Drill Company of Ottumwa, Iowa. Original application filed February 26, 1912. Serial No. 679-956. Divided and this application filed July 22, 1912. Serial No. 710,773. Patented May 13, 1913.

1,061,990. Smoothing-drag. Morgan Davison, of Almeda, Texas. Filed February 4, 1913. Serial No. 746,247. Patented May 20 1913.

1,062,528. Ditching-machine. William J. Abbott, of Algiers, Indiana. Filed May 3, 1912. Serial No. 694,847. Patented May 20, 1913.

1,062,655. Surface-heater. Walter Macleod, of Cincinnati, Ohio. Filed April 26, 1911. Serial No. 623,512. Patented May 27, 1913.

1,062,862. Rock-drill tester. William D. Paynter, of Grass Valley, California. Filed August 7, 1912. Serial No. 713,794. Patented May 27, 1913.

1,063,194. Engine for rock-drills. George H. Gilman, of Claremont, New Hampshire, assignor to Sullivan Machinery Company, of Claremont, New Hampshire, a corporation of Maine. Filed January 3, 1911. Serial No. 600,403. Patented June 3, 1913.

1,063,474. Drag and grader. Tola Fred Stober, of West Grove, Iowa. Filed August 1, 1912. Serial No. 712,812. Patented June 3, 1913.

1,063,792. Composition of matter. Arthur G. Harris, of Lancaster County, Nebraska. Filed November 29, 1910. Serial No. 594,634. Patented June 3, 1913.

1,063,889. Rock-crusher. Charles O. Michaelsen, of Omaha, Nebraska. Filed February 1, 1913. Serial No. 745,726. Patented June 3, 1913.

1,063,899. Process of forming cement blocks. Christ Westergard, of Everett, Washington. Filed July 29, 1911. Serial No. 641,223. Patented June 3, 1913.

1,064,350. Process for the production of coke from wood-tar. Friedrich Wilhelm Lefelmann, of Aue, Germany, Filed October 1, 1912. Serial No. 723,366. Patented June 10, 1913.

1,064,408. Concrete pavement and method of making same. Frederick H. Webster, of Kansas City, Kansas. Filed June 20, 1912. Serial No. 704,736. Patented June 10, 1913.

1,064,876. Bridge. Jose T. Trujillo, of Malachite, Colorado. Filed January 8, 1913. Serial No. 740,887. Patented June 17, 1913.

1,065,007. Rock-drill. James A. Thompson and Edwin M. Mackie, of Chicago, Illinois, assignors to Chicago Pneumatic Tool Company, of Chicago, Illinois, a corporation of New Jersey. Filed November 22, 1906. Serial No. 344,568. Patented June 17, 1913.

1,065,429. Knockdown culvert-pipe. Alex Bruce, of Fargo, North Dakota. Filed March 31, 1913. Serial No. 758,029. Patented June 24, 1913.

1,065,457. Ditching-machine. Harry W. Lutz and William Hutchinson, of Antioch, California. Filed May 9, 1912. Serial No. 696,126. Patented June 24, 1913.

1,065,545. Paving. Ray McDonald, of Austin, Texas. Filed January 20, 1912. Serial No. 672,508. Patented June 24, 1913.

1,065,926. Composition for patching stones. John H. Dugan, of Chicago, Illinois. Filed August 26, 1911. Serial No. 646,219. Patented July 1, 1913.

1,066,196. Corner-bar. Hugh J. Fixmer, of Edison Park, Illinois. Filed July 29, 1912. Serial No. 712,023. Patented July 1, 1913.

1,066,277. Mantle for crushing-heads of gyratory rock-crushers and the like. David Gavine Hunter, of Simmer, and Thomas George Murton, of Jack, Transvaal. Filed October 31, 1910. Serial No. 589,933. Patented July 1, 1913.

1,066,332. Road-scraper. James Andrew Smith, of Carthage, Illinois. Filed January 6, 1913. Serial No. 740,489. Patented July 1, 1913.

1,066,423. Wheel and Drag-line scraper. Elmer M. Sheaffer, of Proctor, Colorado. Original application filed October 23, 1911. Serial No. 656,105. Divided and this application filed February 5, 1912. Serial No. 675,608. Patented July 1, 1913.

1,066,553. Ditching-machine. Harve P. Thomas, of Sumner, Iowa. Filed February 15, 1913. Serial No. 748,543. Patented July 8, 1913.

1,066,778. Tamping-machine. Theodore Ahlborn, of Waterloo, Iowa, assignor to the Waterloo Cement Machinery Corporation, of Waterloo, Iowa. Filed May 24, 1912. Serial No. 699,523. Patented July 8, 1913.

1,066,811. Traction road-machine. James R. Harrison, of Peoria, Illinois. Filed October 19, 1912. Serial No. 726,656. Patented July 8, 1913.

1,066,901. Rock-drill. Charles C. Hansen, of Easton, Pennsylvania, assignor to Ingersoll-Rand Company of New York, New York, a corporation of New Jersey. Filed July 7, 1911. Serial No. 637,277. Patented July 8, 1913.

1,066,945. Sheet-metal culvert. Edwin R. Probert, of Covington, Kentucky. Filed March 3, 1913. Serial No. 751,769. Patented July 8, 1913.

1,067,091. Road Grading and Leveling Device. Elmer E. Woodin, of Mechanicsville, New York. Filed September 11, 1912. Serial No. 719,777. Patented July 8, 1913.

1,067,169. Gate for bridges. John Lyle Harrington, of Kansas City, Missouri. Filed February 23, 1912. Serial No. 679,356. Patented July 8, 1913.

1,067,210. Heating and mixing plant. Horace W. Ash, of Winchester, Massachusetts, assignor to Warren Brothers Company, of Charleston, West Virginia, a corporation of West Virginia. Filed October 18, 1910. Serial No. 587,707. Patented July 8, 1913.

1,067,229. Rock-breaking machine. Cornelius Kimplen, of Minneapolis, Minnesota, assignor to Carrie A. Shove, of Minneapolis, Minnesota. Filed December 12, 1910. Serial No. 596,813. Patented July 8, 1913.

1,067,308. Road-grader. Harry K. Clemons, of St. Paul, Minnesota. Filed February 7, 1912. Serial No. 675,933. Patented July 15, 1913.

1,067,375. Rock-breaking shovel. Olin S. Proctor, of New York, New York, Filed August 18, 1908. Serial No. 449,137. Patented July 15, 1913.

1,067,388. Rock-drilling machine. Daniel Shaw Waugh, of Denver, Colorado, assignor by mesne assignments, to the Denver Rock Drill Manufacturing Company, of Denver, Colorado, a corporation of Colorado. Filed September 12, 1911. Serial No. 648,960. Patented July 15, 1913.

1,067,616. Bridge. Harry E. Matteson, of Maud, Oklahoma, assignor of one-half to Charles W. Friend, of Tecumseh, Oklahoma. Filed January 21, 1913. Serial, No. 743,315. Patented July 15, 1913.

1,068,048. Road-bed and construction thereof. Carleton Ellis, of Montclair, New Jersey. Filed December 7, 1912. Serial No. 735,393. Patented July 22, 1913.

1,068,155. Road-planer. James W. Mosher, of Berkeley, California. Filed May 18, 1912. Serial No. 698,180. Patented July 22, 1913.

1,068,687. Drag-scraper. Joseph S. McKinney and Edward H. McKinney, of Menlo, Kansas. Filed October 14, 1912. Serial No. 725,710. Patented July 29, 1913.

1,068,739. Paving-block. James A. Cogswell, of Boston, Massachusetts. Filed May 25, 1912. Serial No. 699,615. Patented July 29, 1913.

1,069,524. Road-working machine. Preston V. Burson, of Broadway, Ohio. Filed November 5, 1912. Serial No. 729,637. Patented August 5, 1913.

1,069,644. Paving and method of making the same. William A. Newton, of Cabool, Missouri. Filed August 23, 1911. Serial No. 645,468. Patented August 5, 1913.

1,069,660. *Bank-retainer for culverts*. Bartholomew Scully and Alfred Ernest Rigby, of Winnipeg, Manitoba, Canada. Filed July 8, 1912. Serial No. 708,209. Patented August 5, 1913.

1,070,156. *Concrete mixer and spreader*. William L. McFarland, of Fairfield, Illinois. Filed June 1, 1912. Serial No. 700,990. Patented August 12, 1913.

1,070,193. *Road-building machine*. Edward F. Stevens, and William Roach, of Rudolph, Ohio. Filed November 12, 1912. Serial No. 730,998. Patented August 12, 1913.

1,070,248. *Track or roadway for the use of motor-propelled vehicles*. Filed July 18, 1911. Serial No. 639,201. Patented August 12, 1913.

1,070,399. *Machine for consoldiating the road metal in the construction and maintenance of metaled roadways*. Raoul Coutant, of Champeaux, and Emile Jean Jules Salmson, of Paris, France. Filed February 8, 1911. Serial No. 607,384. Patented August 12, 1913.

1,070,381. *Road hone-scraper*. Lorenzo Charles Averell, of Cambria, New York. Filed March 7, 1912. Serial No. 682,189. Patented August 12, 1913.

1,070,382. *Culvert*. Frederick G. Bradbury, of St. Paul, Minnesota. Filed November 30, 1909. Serial No. 530,639. Patented August 12, 1913.

1,070,405. *Excavator-shovel*. Henry G. Butler, of Kenosha, Wisconsin, assignor to Shnable and Quinn, of Chicago, Illinois, a copartnership composed of Emile R. Shnable and John B. Quinn. Filed February 21, 1910. Serial No. 545,086. Patented August 19, 1913.

1,070,807. *Metallic culvert*. Robert Mason Hereford, of New Orleans, Louisiana. Filed June 24, 1913. Serial No. 775,600. Patented August 19, 1913.

1,070,870. *Brick*. James G. Barbour, of Canton, Ohio. Filed February 6, 1913. Serial No. 746,450. Patented August 19, 1913.

1,071,085. *Ditching machine*. Micajah L. Poulter, of Mount Pleasant, Iowa assignor to Iowa Ditching Machine Company, of Mount Pleasant, Iowa a corporation of Iowa. Filed September 27, 1912. Serial No. 722,673. Patented August 26, 1913.

1,071,102. *Metal Culvert*. William T. Shannon, of Cincinnati, Ohio Filed November 11, 1912. Serial No. 730,549. Patented August 26, 1913.

1,071,185. *Sheet-metal culvert*. William T. Shannon, of Cincinnati, Ohio. Filed March 6, 1913. Serial No. 752,338. Patented August 26, 1913.

1,071,261. *Apparatus for treating oils with gasses*. Carleton Ellis, of Montclair, New Jersey. Filed February 5, 1913. Serial No. 746,394. Patented August 26, 1913.

1,071,362. *Rock-crusher*. Thomas L. Smith, of Milwaukee, Wisconsin. Filed August 12, 1910. Serial No. 576,842. Patented August 26, 1913.

1,071,477. *Ditching-machine*. De Witt C. Stowe, of Mooreland, California. Filed September 26, 1912. Serial No. 722,505. Patented August 26, 1913.

1,071,605. *Treatment of slag*. George L. Danforth, Jr., of Chicago, Illinois. Original application filed June 17, 1911. Serial No. 633,885. Divided and this application filed August 23, 1912. Serial No. 716,590. Patented August 26, 1913.

1,072,160. *Road-scraper*. Edwin S. Philips, of Kennett Square, Pennsylvania, assignor to American Road Machine Company, a corporation of Pennsylvania. Filed December 18, 1912. Serial No. 737,408. Patented September 2, 1913.

1,072,532. *Reinforced concrete construction*. Claude A. P. Turner, of Minneapolis, Minnesota. Continuation of application Serial No. 603,562 filed January 19, 1911. This application filed April 17, 1912. Serial No. 691,278. Patented September 9, 1913.

1,072,855. *Crossing.* William Keffer, of Philadelphia, Pennsylvania. Filed May 15, 1913. Serial No. 767,810. Patented September 9, 1913.

1,073,664. *Road-drag.* John H. Cherry and Louis R. Melendy, of Waterloo, Iowa, assignors to the Kelly Manufacturing Company of Waterloo, Iowa. Filed January 23, 1912. Serial No. 672,838. Patented September 23, 1913.

1,073,669. *Combination vehicle-track and curbstone.* Frank F. Fargo, of Portland, Oregon. Filed July 3, 1912. Serial No. 707,490. Patented September 23, 1913.

1,073,820. *Production of Portland cement.* Joseph W. Richards, of South Bethlehem, and Walter S. Landis, of Bethlehem, Pennsylvania. Filed February 28, 1911. Serial No. 611,323. Patented September 23, 1913.

1,073,794. *Bridge or ferry.* Jens Peter Marius Mathias Christensen, of Copenhagen, Denmark. Filed May 10, 1907. Serial No. 372,984. Patented September 23, 1913.

1,073,965. *Fastening means for butt-joint metal culverts.* John H. Dean, of Birmingham, Alabama. Filed February 3, 1913. Serial No. 745,903. Patented September 23, 1913.

1,074,028. *Locomotive or traction-engine.* Gottlieb W. Volz, of Washtunca, Washington, assignor of one-half to Linn L. Bassett, of Washtunca, Washington. Filed March 12, 1912. Serial No. 683,302. Patented September 23, 1913.

1,074,163. *Machine for excavating, elevating, and dumping earth, sand, silt, or gravel.* Wesley Castles, of Melbourne, Victoria, Australia. Filed June 26, 1912. Serial No. 705,985. Patented September 30, 1913.

1,074,480. *Excavating-machine.* Abram D. Ward, of Chicago, Illinois. Filed January 15, 1912. Serial No. 671,256. Patented September 30, 1913.

1,074,492. *Form for concrete culverts.* George W. Countryman, of Birmingham, Iowa. Filed August 24, 1912. Serial No. 716,924. Patented September 30, 1913.

1,074,538. *Excavating-shovel.* Tony Alexander, of San Francisco, California. Filed March 19, 1912. Serial No. 684,844. Patented September 30, 1913.

1,074,589. *Wheeled scraper.* Thomas B. Ferguson, of Hanford, California Filed October 9, 1912. Serial No. 724,772. Patented September 30, 1913.

1,074,717. *Paving-block.* Otto A. Heckel, of St. Louis, Missouri. Filed March 28, 1912. Serial No. 686,946. Patented October 7, 1913.

1,074,983. *Process of making artificial stone and product obtained thereby.* Siegmund Sborowitz, of Berlin, Germany, assignor to Deutsche Konitgesellschaft, M. B. H., of Stralau, near Berlin, Germany. Filed July 3, 1912. Serial No. 707,542. Patented October 7. 1913.

1,076,028. *Water-resistant cement and process of making same.* Carleton Ellis, of Montclair, New Jersey, assignor to New Jersey Testing Laboratories, a corporation of New Jersey. Filed September 30, 1911. Serial No. 652,114. Patented October 21, 1913.

1,076,062. *Rock-breaker.* Mitts Quenner, of Nogales, Arizona, assignor to Quenner Dry Crusher Company, of Douglas, Arizona, a corporation of Arizona. Filed January 24, 1911. Serial No. 604,406. Patented October 21, 1913.

1,076,246. *Rock-drill.* Grant W. Smith, of Chattanooga, Tennessee. Filed March 4, 1912. Serial No. 681,537. Patented October 21, 1913.

1,076,578. *Traction-engine.* Benjamin Holt, of Stockton, California. Filed February 15, 1913. Serial No. 749,168. Patented October 21, 1913.

1,077,486. Two-part dipper for excavating-machines. Walter S. McKee, of Glencoe, Illinois, assignor to Edgar Allen American Manganese Steel Company, of Augusta, Maine, a corporation of Maine. Filed June 11, 1912. Serial No. 703,012. Patented November 4, 1913.

1,077,508. Drift-wheel for piers and bridges. George M. D. Bell, of Lucerne, Indiana. Filed May 22, 1913. Serial No. 769,148. Patented November 4, 1913.

1,077,584. Valve-motion for rock-drills. Lewis C. Bayles, of Johannesburg Transvaal, assignor to Ingersoll-Rand Company, of New York, New York, a corporation of New Jersey. Filed October 28, 1909. Serial No. 525,002 Patented November 4, 1913.

1,077,689. Concrete-waterproofing composition. Carleton Ellis, of Montclair New Jersey, assignor to New Jersey Testing Laboratories, a corporation of New Jersey. Filed February 3, 1912. Serial No. 675,216. Patented November 4, 1913.

1,077,777. Ditching-machine. Edward B. Wilson, of Worland, Wyoming. Filed May 22, 1912. Serial No. 698,992. Patented November 4, 1913.

1,077,856. Pneumatic feed and return rock-drill. Ebenezer R. Ray, of Placerville, California. Filed September 28, 1912. Serial No. 722,873. Patented November 4, 1913.

1,077,911. Rock-drill. Charles A. Hultquist, of Los Angeles, California. Filed February 5, 1913. Serial No. 746,662. Patented November 4, 1913.

1,078,102. Tractor. Charles M. Manly, of Brooklyn, New York. Filed March 13, 1911. Serial No. 614,130. Patented November 11, 1913.

1,078,184. Tooth for excavator buckets or shovels. Michel J. Woznack, of Seattle, Washington. Filed December 29, 1911. Serial No. 668,513. Patented November 11, 1913.

1,078,24[illegible]. Crusher. Eduard Friedrich, of Leipsig-Plagwitz, Germany. Filed May 8, 1912. Serial No. 695,922. Patented November 11, 1913.

1,078,538. Road-roller. Rookes Evelyn Bell Crompton and Ernest Thomas James Tapp, of London, England. Filed July 17, 1913. Serial No. 779,615. Patented November 11, 1913.

1,078,773. Street and road construction. James M. Cosgrove, of Malden Massachusetts. Filed June 16, 1913. Serial No. 773,816. Patented November 18, 1913.

1,078,982. Street-paving. James Banwell, of Cleveland, Ohio, assignor of one-third to Robert L. Beck, of Cleveland, Ohio. Filed May 13, 1912. Serial No. 696,880. Patented November 18, 1913.

1,079,000. Portable mold for concrete culverts. Andrew J. Fisher, of Buda, Illinois, assignor to Illinois Concrete Machinery Co., of Buda, Illinois, a corporation of Illinois. Filed October 25, 1912. Serial No. 727,727. Patented November 18, 1913.

1,079,014. Method of recording the volume or sectional area of concrete in piles formed in the ground. John Murray Leighton, of Belfast, Ireland. Filed March 5, 1912. Serial No. 681,765. Patented November 18, 1913.

1,079,517. Deep-water bridge-pier and means for and method of constructing the same. Allan C. Rush, of Los Angeles, California. Filed August 30, 1911. Serial No. 646,929. Patented November 25, 1913.

1,079,579. Road-grader. Mark J. Phillips, of Webster, South Dakota. Filed April 12, 1913. Serial No. 760,701. Patented November 25, 1913.

1,079,587. Street-scraper. George W. Anthony, of Montpelier, Indiana. Filed June 10, 1912. Serial No. 702,874. Patented November 25, 1913.

1,079,735. Pneumatic rock-drill. Eduard Altenhoff, of Oberhausen, Germany. Filed December 26, 1911. Serial No. 667,911. Patented November 25, 1913.

1,080,252. *Road-drag*. Calvin Ernest Bolt, of Ramsey, Illinois. Filed October 21, 1912. Serial No. 726,998. Patented December 2, 1913.

1,080,292. *Excavating-shovel*. Charles A. Morris, of Montclair, New Jersey, assignor to the Haywood Company, a corporation of New York. Filed April 8, 1911. Serial No. 619,646. Patented December 2, 1913.

1,080,329. *Sheet-metal culvert*. John H. Dean, of Birmingham, Alabama. Filed January 16, 1913. Serial No. 742,420. Patented December 2, 1913.

1,082,437. *Sprinkler*. William Albert Parish, of La Salle, Colorado. Filed April 18, 1913. Serial No. 761,979. Patented December 23, 1913.

1,082,478. *Road and street surfacing*. Joseph Hay Amies, of Philadelphia, Pennsylvania, assignor to the Amies Asphalt Company, of Philadelphia, Pennsylvania, a corporation of South Dakota. Filed March 7, 1913. Serial No. 752,586. Patented December 23, 1913.

Reissued patents for year 1913

13,598. *Method for bonding concrete*. Sylvester W. Flesheim, of Cleveland, Ohio, assignor to the Master Builders Company, of Cleveland, Ohio, a corporation of Ohio. Original No. 1,012,832, dated December 26, 1911, serial No. 634,028. Application for reissue filed May 29, 1913. Serial No. 770,779. Reissued July 22, 1913.

13,614. *Rock-drilling engine*. John George Leyner, of Denver, Colorado, assignor to the J. Geo. Leyner Engineering Works Company, of Littleton, Colorado, a corporation of Colorado. Original No. 651,487, dated June 12, 1900, serial No. 751,037. Application for reissue filed May 26, 1913. Serial No. 769,817. Reissued September 9, 1913.

13,634. *Tractor*. George Cyrus Jett, of Gary, Indiana. Original No. 1,071,427, dated August 26, 1913, Serial No. 681,237. Application for reissue filed September 22, 1913. Serial No. 791,259. Reissued October 21, 1913.

Supplement

1,080,693. *Mold for sidewalk construction*. Joseph W. Holman, Cleveland Ohio. Serial No. 675,337. Filed February 3, 1912. Patented December 9, 1913.

1,080,706. *Rock-drill*. Edwin M. Mackie and Percival F. Doyle, Franklin, Pennsylvania, assignors to Chicago Pneumatic Tool Company, Chicago, Illinois, a corporation of New Jersey. Filed January 19, 1909. Serial No. 473,149. Patented December 9, 1913.

1,080,707. *Rock-drill*. Edwin M. Mackie and Percival F. Doyle, Franklin, Pennsylvania, assignors to Chicago Pneumatic Tool Company, Chicago, Illinois, a corporation of New Jersey. Filed February 8, 1909. Serial No. 476,616. Patented December 9, 1913.

1,081,060. *Excavating and conveying apparatus*. Joseph L. Potter, Indianapolis, Indiana, Filed June 21, 1911. Serial No. 634,587. Patented December 9, 1913.

1,081,295. *Fastening means for butt-joint metal culverts*. John H. Dean, Birmingham, Alabama, Filed April 15, 1913. Serial No. 761,310. Patented December 16, 1913.

1,081,454. *Excavator*. Leo A. Krupp, Findlay, Ohio, assignor to The Buckeye Traction Ditcher Company, Findlay, Ohio, a Corporation of Ohio. Filed July 18, 1913. Serial No. 779,696. Patented December 16, 1913.

1,081,487. *Portable excavating-machine*. John H. Carr, Alhambra, California, assignor of one-half to Howard E. Marsh, Palms, California. Filed April 13, 1912. Serial No. 690,588. Patented December 16, 1913.

1,081,527. *Rock-drill chuck.* Frank Frans, Walter S. Tower, and Archibald H. Wells, Wallace, Idaho. Filed December 9, 1912. Serial No. 785,787. Patented December 16, 1913.

1,081,721. *Rock-cutting drill-bit.* Walter E. Carr, Littleton, Colorado, assignor to the Ingersoll-Rand Company, New York, New York, a Corporation of New Jersey. Filed Mar. 3, 1913. Serial No. 751,841. Patented December 16, 1913.

1,081,979. *Transparent pavement.* Leo G. Mullin, Crafton, Pennsylvania. Filed June 16, 1913. Serial No. 773,849. Patented December 23, 1913.

1,082,011. *Excavating-machine.* Harold H. Damman, Ellensburg, Washington. Filed August 17, 1912. Serial No. 715,581. Patented December 23, 1913.

1,082,641. *Ditching-plow.* Louis E. Ludwig, Dale, Indiana. Filed May 17, 1912. Serial No. 697,993. Patented December 30, 1913.

1,082,722. *Method of constructing roadways.* Daniel B. W. Alexander, Los Angeles, California. Filed April 9, 1912. Serial No. 689,452. Patented December 30, 1913.

1,082,959. *Road-machine.* Henry T. Knight, Summerland, Mississippi. Filed February 6, 1913. Serial No. 746,657. Patented December 30, 1913.

1,083,030. *Fluid-distributing machine.* Chas. P. Price, Malden, Massachusetts, assignor by mesne assignments, to Bituminous Road Implement Company, a corporation of Massachusetts. Filed Feb. 23,1910. Serial No. 545,396. Patented December 30, 1913.

PATENTED METHOD OF ROAD CONSTRUCTION

All manufacturers of road materials were requested to submit description of any patented methods of road construction which they thought should properly be included in this chapter. The information contained herein is based upon the replies received.

Bitulithic Pavement.—This pavement is laid under several patents, the basic principle United States patent being no. 727,505, issued to the late Frederick John Warren. The scope of the patent as given in the opinion in Warren Brothers Company vs. Owosso, Michigan, written by Mr. Justice Lurton, then Presiding Justice of the United States Circuit Court of Appeals, Sixth Circuit, is as follows:

> Warren's invention, shortly stated, consists in the discovery that an aggregate of large and small pieces of stone, together with a certain proportion of stone dust, all mixed together and thoroughly permeated with bitumen or asphalt, results, when set, in a compact, stable structure, is less liable to disintegrate from traffic or weather than any other method of grading or arranging the mineral constituents. Under the evidence, the particles are more compact in their relation to each other and there is a minimum of friction in their interaction. The larger pieces of stone withstand the tendency of the small grains or dust to slip by each other and change the form of the pavement by disintegration and lumpy spots. The result is, therefore, a stability due to the arrangement of the mineral structure which enables the use of a softer asphalt or bitumen than would be otherwise feasible, inasmuch as a greater proportion of the wear and strain is carried by the mineral elements than by the binding constituent.

The Bitulithic surface may be laid on any suitable substantial foundation, such as macadam, new or old; crushed stone properly compressed; concrete, either new or resurfacing foundations of old pavements; old brick; granite block or cobble stones. Bitulithic surface is described by the owners of the patents as follows:

> *Surface:* Upon the foundation is spread the wearing surface which is compressed with a heavy road roller to a thickness of 2 inches. The surface mixture is made of the best stone obtainable, varying in size from a maximum of 1 inch or 1½ inches down to an impalpable powder, the various sizes of smaller stone, sand and impalpable powder being provided to fill the spaces between eth larger stones. The proportions used of the various sizes of mineral are pre-determined by physical tests with a view to obtaining the smallest percentage of air spaces or voids in the mineral mixture, and vary with the character and shape of particles of the stone used in each particular case. After the proportions have been determined, the mineral material is passed through a rotary dryer, from which it is

carried up an elevator and through a rotary screen which separates the mineral material into its several different groups of sizes. The proper proportion by weight of each of these sizes is secured by the use of a scale having seven beams, the exact required amount being weighed out, and run into a double shaft rotary mixer. There it is combined with a bituminous cement which is also accurately weighed in the proper portion. The whole is then thoroughly mixed together and dumped, while still hot, into carts, hauled to the street and spread and thoroughly rolled with heavy steam road rollers.

Grit Surface: After the surface is thoroughly rolled, a flush coat of quick drying bituminous cement is applied to the surface, thoroughly sealing it and increasing its waterproofness. There is then applied a thin layer of finely crushed stone, varying from ⅛-inch to ¾ of an inch in size, according to the roughness of the surface desired. The pavement is again thoroughly rolled, leaving the street in a finished condition.

Warrenite Road.—Warrenite Road is a modification of Bitulithic pavement adapted to meet the traffic conditions which exist on country highways.

Bitustone Double Bond Roadway.—This is laid under United States patent no. 1,001,695 issued to August E. Schutte of Northboro, Mass., on August 29, 1911. The construction is briefly described by the eighth claim of the patent, as follows:

> A pavement for foot or vehicular traffic, comprising a mineral aggregate the particles of which are in substantial contact and are otherwise surrounded and bonded together by a rigid non-liquefiable cement, the voids between the bonded mineral particles being filled with elastic cement.

The total depth of the construction recommended by the patentee is 5 inches, as follows:

1. *Foundation or Bottom Course;* of ordinary Portland cement concrete, the mineral aggregate of which may be either crushed stone, gravel, slag or other suitable material.

2. *Bonding Course;* of hard stone or gravel, of nearly uniform size, varying from about 1 inch to ½ inch mixed with neat Portland cement in the proportion of one part cement to six parts stone. The bonding course is tamped and well embedded into the mortar of the foundation or bottom course.

3. *Filler;* after the bonding course is thoroughly set, presenting particles of crushed stone strongly united with neat Portland cement, but containing large percentage of voids between the individual particles, hot bituminous cement especially prepared for the purpose, is flushed over and penetrates into the spaces of the bonding course, and while the cement is still hot the whole surface is covered with fine crusher screenings or coarse sand.

Hassam Pavement.—Upon a well compacted subgrade is spread not less than 5 inches of broken stone in sizes varying from 1½ inches to 2½ inches in diameter. The stone must be clean and fresh with no dirt. After this is rolled and brought to desired cross section the compressed stone is thoroughly grouted. The grout consists of two parts of sand to one or more parts of Portland cement. This grouting is done with a Hassam Patent Grout Mixer driven by a gasoline engine. Before the initial set takes place and during the process of grouting the road is thoroughly rolled. Upon the top of the pavement is then spread a thin layer of pea stone which is also rolled. The Hassam Paving Company, Worcester, Mass.

Patented Materials for Road Construction in which the Method of construction is not patented

To provide information concerning materials the *preparation* of which involves a patent but which are not patented as to their method of *application*, a letter was sent to all road material manufacturers asking them to submit specifications or other suitable material for a special chapter to cover these conditions. The following reports comprise all that have been received:

Amiesite.—A paving material, the ingredients of which are incorporated into a paving mass under patents issued to Joseph Hay Amies and Warren Brothers Company. It consists of the best grade of crushed stone or gravel, graded in sizes from 1½ to ¼ inch (as to give the inherent stability required for a permanent road), chemically treated before applying the asphalt and other material required for the finished product. The stone is then coated, without heating, with an asphaltic cement, composed of refined asphalt containing not less than 98 per cent bitumen and other ingredients. The run-of-the-crusher Amiesite is to be used in the first course; the second course is either ½ or ¼-inch stone, treated in the same manner except it requires additional asphalt per ton of Amiesite, known as "Amiesite Filler." The material is shipped to destination ready for immediate use, without further treatment. By way of summary, it may be stated that the ingredients of Amiesite are crushed stone, asphalt, lime and naptha.

Fibred Asphalt Pavement.—This pavement is laid under several patents, its basic principles involved being covered by United States patent 1040321, applied for April 8, 1911, and issued its patentee, George A. Henderson, of St. Albans, W. Va., on October 8, 1912. The invention relates principally to the art of denaturing hard-wood and preserving it in the following manner: a billet of hard-wood is shredded into small particles of un-uniform lengths of 1½ inches down to wood flour, the flour itself being eliminated from the aggregate by screening. The particles are denatured by the process used by the tannin extract manufacturers, in which process all sap, essence and the more evaporable and deterioble elements in the wood are extracted, the remaining particles being thereby rendered abnormally enlarged and porous. In their subsequently dried and heated condition the wood particles, because of their porosity, are susceptible of impregnation, by absorption, by a non-deteriable, non-evaporating matter (such as asphalt), in lieu of the sap, etc., removed. The heating of the dried particles, to prevent the premature congealing of the molten asphalt before reaching the particles' pores, has also for its object the partial contracting of the enlarged particles. The consequent contraction in the size of the particles' pores correspondingly reduces the amount of asphalt required to completely fill them.

The wood fiber is a waste product of tannin extract manufacturers, who use hard-wood and no bark in their process. The particles are taken from the leaches on endless belts; dried, screened, heated and then mechanically mixed with a predetermined uniform percentage of asphalt, sufficient to fill the pores and voids in the mass when finally contracted and compressed. The material, in its partially impregnated and partially contracted condition is deposited at the mouth of its mixer into moulds 4 by 6 feet, these blocks being compressed on all sides only 3 to 4 inches, and allowed to cool, when they will remain intact for shipment, but are readily disintegrated in a breaker stationed at the front of a portable reheating machine, designed to travel over the road to be paved, in which machine the coated particles are deposited and heated to from 250 to 275° F. This heating results in the final contraction of the fiber to its normal size, as it was before being chipped from its original log, and the entrapping of its asphalt content, thereby insuring penetration to the most minute pore of the fiber, thus thoroughly preserving it, without affecting its natural resiliency. The mass emerges from the rear of the reheating machine in a continuous 18-inch flow on to the previously prepared road base, where it is mechanically spread 4 inches thick, steam roller compression immediately reducing it to a compact mass 2 inches thick. The interlocking of the un-uniform preserved sinews of the hard-wood, in conjunction with the substantial penetration of the binding asphalt, in addition to surrounding the particles, is relied upon for durability.

Fibred Asphalt may be laid on any substantial foundation such as old macadam, crushed stone, concrete, old brick, granite or wood blocks or cobble stones. For use on country roads a curb or shoulder is not necessary.

The only patent in connection with Westrumite Asphalt Pavement, exist in the patents for the emulsifying of the native bitumen (not oil residuum) of which it is made, there are also several independent companies within the United States and Canada manufacturing and marketing this product.

Westrumite.—The patents in connection with Westrumite Asphalt pavement protect the emulsifying of the asphaltum. There are also several independent companies in the United States, Canada and Europe manufacturing and marketing Westrumite.

Westrumite is an asphaltic cement, temporarily liquified by emulsification. It is shipped in tight barrels and without any further preparation is mixed *cold* with the proper stone matter in an ordinary concrete mixer, is laid on any suitable foundation and thoroughly compacted, with a five to eight ton roller. The evaporation of the vehicle leaves the asphaltic cement as the binder.

There are two principle types of construction. The 1st is the mixing process or asphaltic concrete construction, using hard suitable crushed stone of two sizes, namely: ¾ inches to ½ inch and ¼ inch to and including dust. The latter especially is carefully tested and made to conform to specifications designed to give the greatest density. The mixture of the stone and the quantity of Westrumite, are ascertained by a determination of the voids in the stone matter. After the surface is thoroughly compacted a flushing coat is used to fill any small voids or roughness on the surface and the whole is again thoroughly rolled. The surface thickness is 1½ inches for light traffic and 2 inches for heavy traffic.

The other principle type of construction is the combination of the mixing and penetration methods. Crushed stone ranging in size from 2 inches to 1 inch, after being thoroughly coated with Westrumite Asphalt, is spread on any suitable foundation to make a wearing surface of at least 2 inches thickness after rolling. This stone course is not compacted. A second course composed of Westrumite Asphalt and crushed stone from ½ inch to and including dust, in proper proportion is then spread over the coarse stone in sufficient amount to thoroughly fill all the voids. The liquid consistency of this mortar causes it to penetrate and fill the voids of the coarse stone. This process is assisted by the pressure of the roller. The seal coat is also applied in this construction.

Recently another type of construction has come into use which is a bituminous carpet of ½ inch thickness on concrete roads. This carpet is composed of Westrumite Asphalt, mixed *cold* in an ordinary concrete mixer, with stone matter ranging from ¼ inch to and including dust, properly graded. This mixture is spread on the concrete surface to a uniform depth of ½ inch by means of a templet. Owing to the fact that Westrumite asphaltic cement is an aqueous emulsion the adhesion to even damp concrete surfaces is perfect.

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[1] Only modern works in English, which are easily obtainable, have been given in this list. Articles in periodicals, which are both numerous and valuable, and publications of the various State organizations and federal departments have been excluded. The publications of the Office of Public Roads, U. S. Department of Agriculture, are given in a separate list.

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BULLETINS, CIRCULARS AND DOCUMENTS

Publications of the Office of Public Roads, U. S. Department of Agriculture[1]

ANNUAL REPORTS

Report of the special agent and engineer for road inquiry for 1893. Roy Stone.

Report of the special agent and engineer for road inquiry for 1894. Roy Stone.

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1. State laws relating to the managment of roads, enacted in 1888–1893. Compiled by Roy Stone.
2. Proceedings of the Minnesota Good Roads Convention, held at St. Paul, Minn., January 25 and 26, 1894.
3. Improvement of the road system of Georgia. O. H. Sheffield.
4. Report on road-making materials in Arkansas. J. C. Branner.

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[1] The department supply of a number of these publications is exhausted, but copies may be had by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 5 cents each except in the case of bulletins, which range from 5 to 30 cents. A revised list of publications of the Office of Public Roads is issued every three months, and copies can be had upon request to that office.

5. Information regarding road materials and transportation rates in certain States west of the Mississippi River.
6. Information regarding roads, road materials, and freight rates in certain States north of the Ohio River.
7. Information regarding roads and road-making materials in certain eastern and southern States.
8. Earth roads: hints on their construction and repair. Roy Stone.
9. State aid to road building in New Jersey. Edward Burrough.
10. Proceedings of the National Road Conference, held at Westminster Church, Asbury Park, N. J., July 5 and 6, 1894.
11. Proceedings of the Virginia Good Roads Convention, held in Richmond, Va., October 18, 1894.
12. Wide Tires. Laws of certain States relating to their use, and other pertinent information. Compiled by Roy Stone.
13. Kentucky highways: history of the old and new systems. M. H. Crump.
14. Good roads: extracts from messages of governors. Compiled by Roy Stone.
15. Proceedings of the Good Roads Convention of Texas, held at Turner's Hall, in Houston, Tex., February 19, 1895.
16. Notes on the employment of convicts in connection with road building. Compiled by Roy Stone.
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17. Historical and technical papers on road building in the United States. Compiled under the direction of Roy Stone.
18. State laws relating to the management of roads, enacted in 1894–1895. Compiled by Roy Stone.
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19. Progress of road construction in the United States: Reports by Delegates to National Road Parliament, held at Atlanta, Ga., October 17–19, 1895.
20. Traction tests. S. T. Neely.
21. Proceedings of the International Goods Roads Congress, held at Buffalo, N. Y., September 16 to 21, 1901.
22. Proceedings of the Third Annual Good Roads Convention of the Board of Supervisors of the State of New York, held at Albany, N. Y., January 28 and 29, 1902.
23. Road conventions in the southern States, and object-lesson roads constructed under the supervision of the Office of Public Road Inquiries, with the coöperation of the Southern Railway.
24. Proceedings of the North Carolina Goods Roads Convention, held at Raleigh, February 12 and 13, 1902. Compiled by J. A. Holmes.
25. Proceedings of the Jefferson Memorial and Interstate Good Roads Convention, held at Charlottesville, Va., April 2, 3, and 4, 1902.
26. Proceedings of the National Good Roads Convention, held at St. Louis, Mo., April 27 to 29, 1903.
27. The construction of sand-clay and burnt-clay roads. W. L. Spoon.
28. The decomposition of the feldspars. A. S. Cushman and Prevost Hubbard.
29. The Construction of Macadam Roads. A. B. Fletcher.
30. The Corrosion of Iron. A. S. Cushman.
31. Examination and classification of rocks for roadbuilding, including the physical properties of rocks with reference to their mineral composition and structure. E. C. E. Lord.
32. Public-road mileage, revenues, and expenditures in the United States in 1904. M. O. Eldridge.

33. Road materials of southern and eastern Maine. Prepared in coöperation between the United States Geological Survey, the State Survey Commission of Maine, and the Office of Public Roads. Henry Leighton and E. S. Bastin.
34. Dust preventives. Prevost Hubbard.
35. The preservation of iron and steel. A. S. Cushman.
36. Descriptive catalogue of the road model exhibit of the Office of Public Roads, Alaska-Yukon-Pacific Exposition. Prepared by the Office of Public Roads.
37. Examination and classification of rocks for road building, including the physical properties of rocks with reference to their mineral composition and structure. Edwin C. E. Lord.
38. Methods for the examination of bituminous road materials. Prevost Hubbard and Charles S. Reeve.
39. Highway bridges and culverts. Charles H. Hoyt and William H. Burr.
40. The road material resources of Minnesota. George W. Cooley.
41. Mileage and cost of public roads in the United States in 1909. J. E. Pennybacker, Jr. and Maurice O. Eldridge.
42. New Hampshire highways. Report of an inspection of highways in the State of New Hampshire, August, 1911. Charles H. Hoyt.
43. Highway bridges and culverts. Charles H. Hoyt and William H. Burr.
44. The physical testing of rock for road building, including the methods used and the results obtained. June, 1912. Albert T. Goldbeck and Frank H. Jackson.
45. Data for use in designing culverts and short span bridges. C. H. Moorefield.
46. Oil-mixed portland cement concrete. August, 1912. L. W. Page.
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48. Repair and maintenance of highways. L. I. Hewes.

CIRCULARS[1]

14. Addresses on road improvement. Roy Stone.
15. An act to provide for the construction of roads by local assessment, county, and State aid, passed by the New York Assembly.
16. Highway Taxation: Comparative results of labor and money systems.
17. Origin and work of the Darlington Road League. Roy Stone.
18. Report of committee on legislation Adopted by the State Good Roads Convention, held in Richmond, Va., October 10 and 11, 1895.
19. Traffic of the country roads.
20. Comments on systems of maintaining country roads.
21. Methods of constructing macadamized roads. Extract from a report prepared by the chief engineering inspector of the Local Government Board. (England.)
22. Appeal for organization of State and local road-improvement societies. C. A. Locke.
23. Money value of good roads to farmers. W. C. Latta.
24. Highway maintenance and repairs. Revision of Circulars 16, 20, and 24.
25. Brick paving for country roads.
26. Going in debt for good roads.
27. Cost of hauling farm products to market or to shipping points in European countries.
28. Addresses on road improvement in Maine, New York, North Carolina, and Illinois. Roy Stone.

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[1] Circulars 1 to 13 were of temporary character and are no longer in print.

29. Theforces which operate to destroy roads, with notes on road stones and problems therewith connected. C. L. Whittle.
30. Repairs on macadam roads. E. G. Harrison.
31. Must the farmer pay for good roads? Otto Dorner.
32. State aid to road building in Minnesota. A. B. Choate.
33. Road improvement in governors' messages. Compiled by Roy Stone.
34. The social, commercial, and economic phases of the road subject. W. H. Moore.
35. Road improvement in New York.
36. List of national, State, and local road associations and kindred organizations in the United States.
37. The railroads and the wagon roads. A. L. Craig.
38. A study of rock decomposition under the action of water. A. S. Cushman.
39 to 46 inclusive. Public roads of Washington, Arizona, Arkansas, Oregon, Iowa, Virginia, North Carolina, and Alabama: Mileage and expenditures in 1904. M. O. Eldridge.
47. Tar and oil for road improvement: Report of progress of experiments at Jackson, Tenn.
48 to 87 inclusive. Public roads of Tennessee, New Hampshire, Maryland Maine, New Mexico, Pennsylvania, Montana, Wyoming, North Dakota, South Dakota, Kentucky, Florida, South Carolina, Nebraska, Nevada, Kansas, Idaho, Colorado, Indiana, Oklahoma, Utah, California, Illinois New Jersey, Missouri, Louisiana, New York, Ohio, Georgia, Mississippi, West Virginia, Wisconsin, Minnesota, Delaware, Michigan, Rhode Island, Massachusetts, Texas, Connecticut, and Vermont: Mileage and expenditures in 1904. M. O. Eldridge.
88. Publications of the Office of Public Roads. Revised June, 1909. Compiled by A. E. Draper. (Out of date.)
89. Progress reports of experiments with dust preventives.
90. Progress reports of experiments in dust prevention, road preservation and road construction.
91. Sand-clay and earth roads in the Middle West. W. L. Spoon.
92. Progress reports of experiments in dust prevention and road preservation.
93. Bitumens and their essential constituents for road construction and maintenance. Prevost Hubbard.
94. Progress reports of experiments in dust prevention and road preservation, 1910. Prepared by the Office of Public Roads.
95. Special road problems in the southern States. D. H. Winslow.
96. Naphthalene in road tars. I. The effect of naphthalene upon the consistency of refined tars. Prevost Hubbard and Clifton N. Draper.
97. Coke-oven tars of the United States. Prevost Hubbard.
98. Progress reports of experiments in dust prevention and road preservation, 1911. December, 1912.
99. Progress reports of experiments in dust prevention and road preservation, 1912.
100. Typical specifications for the fabrication and erection of steel highway bridges.

Farmers' Bulletins

95. Good roads for farmers. M. O. Eldridge.
136. Earth roads. M. O. Eldridge.
235. Cement mortar and concrete: preparation and use for farm purposes. P. L. Wormeley.
239. The corrosin of fence wire. A. S. Cushman.
311. Sand-clay and burnt-clay roads. W. L. Spoon.

321. The use of the split-log drag on earth roads. D. W. King.
338. Macadam roads. A. B. Fletcher.
403. The construction of concrete fence posts. Prepared by the Office of Public roads.
461. The use of concrete on the farm. Prepared by the Office of Public Roads.
505. Benefits of improved roads. September, 1912.

YEARBOOK ARTICLES

(Extracts from the Yearbooks of the Department of Agriculture)

Yearbook of the Department of Agriculture, 1894

24. Best roads for farms and farming districts. Roy Stone.
25. State highways in Massachusetts. G. A. Perkins.
26. Improvement of public roads in North Carolina. J. A. Holmes.

Yearbook of the Department of Agriculture, 1895

40. Coöperative road construction. Roy Stone.

Yearbook of the Department of Agriculture, 1897

118. Object-lesson Roads. Roy Stone.

Yearbook of the Department of Agriculture, 1898

149. Steel-track wagon roads. Martin Dodge.
150. Construction of good country roads. M. O. Eldridge.

Yearbook of the Department of Agriculture, 1899

172. Progress of road building in the United States. M. O. Eldridge.

Yearbook of the Department of Agriculture, 1900

204. The selection of materials for macadam roads. L. W. Page.
210. Mountain Roads. J. W. Abbott.

Yearbook of the Department of Agriculture, 1901

240. Road building with convict labor in the southern States. J. A. Holmes.
245. Government coöperation in object-lesson road work. Martin Dodge.
253. Mountain roads as a source of revenue. J. W. Abbott.

Yearbook of the Department of Agriculture, 1902

296. Use of mineral oil in road improvement. J. W. Abbott.

Yearbook of the Department of Agriculture, 1903

305. Progress of road building in the Middle West. R. W. Richardson.
332. Building Sand-clay roads in southern States. W. L. Spoon.

Yearbook of the Department of Agriculture, 1904

350. Practical road building in Madison County, Tennessee. S. C. Lancaster.

Yearbook of the Department of Agriculture, 1905

407. Progress of road legislation and road improvement in the different States. Prepared in the Office of Public Roads.

Yearbook of the Department of Agriculture, 1906

412. Object-lesson roads. L. W. Page.

Yearbook of the Department of Agriculture, 1907

— 443. Dust preventives. L. W. Page.

Yearbook of the Department of Agriculture, 1909

513. Information in regard to fabricated wire fences and hints to purchasers. Allerton S. Cushman.

Yearbook of the Department of Agriculture, 1910

535. Progress and present status of the good roads movement in the United States. Logan Waller Page.
538. Bituminous dust preventives and road binders. Prevost Hubbard.

LECTURE SYLLABUS

Syllabus of Illustrated lecture on roads and road building. Office of Experiment Stations, Farmers' Institute Lecture 7. Office of Public Roads.

Publications of the Bureau of Chemistry on Road Materials

The following publications were issued by the Bureau of Chemistry when the Office of Public Roads formed a part of that Bureau.

BULLETINS

79. The testing of road materials, including the methods used and the results obtained in the road material laboratory in collaboration with the Office of Public Road Inquiries. L. W. Page and A. S. Cushman.
85. The cementing power of road materials. L. W. Page and A. S. Cushman.
92. The effect of water on rock powders. A. S. Cushman.

CIRCULAR

17. The useful properties of clays. A. S. Cushman.

SPECIAL BULLETIN

A special bulletin on "Highway Bonds" has been prepared by the Office of Public Roads and will be issued as a congressional document.

Publications of the Joint Congressional Committee on Federal Aid in the Construction of Post Roads

Public road systems of foreign countries and of the several States. Hearings before the Joint Committee.

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Alabama

State Highway Department
  Bulletin 1. State highway laws of Alabama in effect April 5, 1911.
  Bulletin 2. Roads and road materials of Alabama. W. F. Prouty.
  Bulletin 3. First annual report of the State highway commission, 1912.
  Bulletin 4. Second annual report of the State highway commission 1913.
Third annual report will be out in 1914.
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Alaska

Board of Road Commissioners, War Department
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Arizona

Reports of State Engineer

Arkansas

Highway Bulletin. Issued monthly by State Highway Commission.

California

Report Surveyor General, 1854
Comments on California and Missouri mail stage road, and Atlantic and Pacific Railroad; also recommendation for appropriation for locating and constructing portion of proposed California and Missouri stage road lying between some point in great central valley of State, and its eastern boundary.
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  Road sprinkling. Paper read before State Convention of County Supervisors at San José, by M. Manson. 1896.
Commissioner of Public Works
  Reports, 1894 to 1904.
Department of Highways
  Biennial Reports, 1895–96 to 1904–06.
  Bulletin 1. An act to create a bureau of highways and prescribe its duties and powers and to make an appropriation for its expenses (1895).
  Bulletin 2. An act providing for the erection and operation of rock crushing plants at the State prisons for the preparation of highway material for the benefit of the people of the State, and providing for the necessary advances and appropriation of money to carry out said work (1895).
  Bulletin 3. Physical features of the State.
  Bulletin 4. The effect of roads on industrial development.
  Bulletin 5. Proposed highway legislation with comments and resolutions thereon.
State Engineer
  Reports from 1878–79 to 1908–10–12.
State Mineralogist
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  (Macadam in Alameda, Los Angeles, Marin, San Francisco, Solano, and Sonoma Counties.)
California's State Highway. Austin B. Fletcher, Highway Engineer, California Highway Commission, August 5, 1912.
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Colorado

State Highway Commission
  Biennial Report, first and second, 1910-1912.
  Bulletin 1. Act establishing highway commission, 1910, Regulations, etc.
  Bulletin 2. Act establishing highway commission, 1911, and road laws of Colorado.
  Bulletin 3. General rules, regulations and highway commission Act. 1913.

Connecticut

State Highway Commissioner
  Annual Reports, 1895 to 1900, inclusive.
  Biennial Reports, 1901-02 to 1907-08, inclusive.

Delaware

Delaware State Highway Commission.
  Biennial Report, first, 1903-04.
New Castle County State Highway Commission.
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  (6) 1908-1913 inclusive, Wilmington.

District of Columbia

Engineer Department
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  Report of the Operations of the Engineer Department, 1899-1900 to 1911-12.

Florida

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  Bulletin 2. Roads and road materials in Florida. E. H. Sellards, et al.

Georgia

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  Bulletin 8. A preliminary report on roads and road building materials of Georgia (1901). S. W. McCallie.
  Bulletin 24. A second report on the public roads of Georgia (1910). S. W. McCallie. (First report, Bulletin 8.)
  Bulletin 28. A third report on the public roads of Georgia (1912). S. W. McCallie.
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  Bulletin, vol. 9, no. 5. Good roads for Georgia.
State Prison Commission.
  Annual Reports, thirteenth to sixteenth, 1909-10 to 1912-13.

Idaho

Agricultural Experiment Station
  Bulletin 45, 1904. Road construction.
  Bulletin 50, 1905. Road construction.
State Engineer
  Biennial Reports, third, 1899 to 1900; sixth 1904 to 1906; eighth 1908 to 1910; ninth 1911-1912.

Illinois

Agricultural Experiment Station
Bulletin 65, 1901. Road construction and maintenance.
Highway Commission
Annual Reports from 1906 (1906 and 1908–1909 out of print). 1910–11–12.
Bulletin 1. Earth road drag, how to make it and how to use it (out of print).
Bulletin 2. Road drag law and rules for dragging.
Bulletin 3. How to secure bridge plans. Information for county, township, and municipal officers (out of print).
Bulletin 4. Crushed stone prepared by convict labor and rules for its use (out of print).
Bulletin 5. General rules and regulations (out of print).
Bulletin 6. Modern bridges for Illinois highways (out of print).
Bulletin 7. Township hard road law (out of print).
Bulletin 8. Manual of Instructions to engineers.
Bulletin 9. Modern bridges (which is a revision of bridge bulletin No. 6.)

Under the present State Highway Department, the following publications have been issued:
Bulletin 1. Qualifications for county superintendents of highways. (out of print).
Bulletin 2. Information for county boards.
Bulletin 3. Policy of the State highway commission.
Bulletin 4. Part 1. Suggestions for the Guidance of County Superintendents of Highways.
Bulletin 5. Rules and regulations of the Illinois highway commission applying to bridge design.
Bulletin 6. Synopsis of the Illinois Road Law.
State Geological Survey.
Bulletin 9. Paving brick and paving brick clays of Illinois (1908).
Illinois University. Engineering Experiment Station.
Bulletin 65. Construction and care of earth roads. Ira O. Baker.

Indiana

State Geological Survey.
30th Annual Report, 1905. Roads and road materials of Indiana. W. S. Blatchley and Assistant.
State Statistician, Annual Report for 1910. Data on mileage of improved roads.

Iowa

State Highway Commission.
Annual reports 1904–05 (out of print).
Manual for Highway Officers, 1905–06 (out of print).
Bulletin, vol. 3, no. 1. Road and Bridge Improvement in Iowa, 1908.
Service Bulletin no. 1. June edition. (A summary of the Iowa road laws.)
Service Bulletin no. 2. Standard Specifications for Concrete Reinforcement Bars.
Monthly Service Bulletin. Published monthly beginning December, 1913.
Supplement to vol. II, no. 1, Monthly Service Bulletin. Standard Specifications for Highway Bridge Construction.
Iowa State College. Engineering Experiment Station.
Bulletin, vol. 2, no. 6. The good roads problem in Iowa. Iowo State Highway Commission.

Engineering Experiment Station, Iowa State College.
  Bulletin 28. Road Legislation and Administration, October, 1912.
  Service Bulletin 1. New road legislation enacted by the thirty-fifth general assembly.

Kansas

Agricultural Experiment Station
  Bulletin 142, 1907. Road improvement.
State Agricultural College
  Bulletin, vol. 3, no. 6. Highway improvement: construction and maintenance of earth, sand-clay, and oiled earth roads, and culverts. W. S. Gearhart.
  Bulletin 1, vol. 5. Land drainage. H. B. Walker.

Kentucky

Governor's Message, 1827
  State control of roads and bridges urged.
State Board of internal Improvement
  Annual report, 1837. Directions for construction of turnpike roads.
Governor's Message, 1838-39
  Review of history of internal improvement of the past. A large number of reports and bulletins were issued by the State Board of Internal Improvement and the Legislature regarding toll roads.
State Auditor
  Biennial report, 1881-83. Statement showing number of turnpikes in which State owns stock, length of each in miles, whole number of shares of stock, number owned by State, amount per share, average per cent stock has paid for six years prior to January 1, 1882; amount of dividends paid State, cost for salaries to gate keepers and officers, and cost of repairs. 1882-1885.
State Geological Survey
  Report of progress, 1886-87. Historic sketch of turnpike road and railroad building in Kentucky. 1775-1820.
Bureau of Agriculture, Horticulture and Statistics
  Annual report, eighth, part 2, 1889. Conditions of public highways in Kentucky, 1889.
Bureau of Agriculture, Labor and Statistics
  Biennial report, twelth, 1895-97, Estimated number of miles of macadamized turnpikes in State; end of twelve months will probably see last of old toll system and inauguration of new system of maintenance by taxation, 1897.
  Biennial report, thirteenth, 1898-99.
  Biennial report, eighteenth, 1908-09, Division 4. Roads.
State Farmers' Institutes
  Annual State Farmers' Institute.
  First, 1906. Country roads. Address on roads.
  Second, 1907. Dirt roads, their construction and maintenance.
  Third, 1908. County roads.
  Fourth, 1909. Good roads in Kentucky.
  Fifth, 1910. Road legislation in Kentucky. McCracken County Judge.
  Report relative to public improvements, 1909.
State department of public roads, 1913
  Bulletin 3. Information concerning the Office of Public Roads.
  Bulletin 4. Compilation of Kentucky road laws.
  Bulletin 5. Split Log Drag.
  First Biennial Report of the Department of Public Roads, 1913.

Louisiana

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  Biennial Reports, 1872-73 to 1908-10, inclusive.
Agricultural Experiment Station
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Maine

Commissioner of highways
  Annual Reports 1905 to 1913 inclusive.
  Bulletin 1. Improvement of country roads, 1909.
  Bulletin 2. Road administration.
  Bulletin 3. Duties of selectmen and road commissioners.

Maryland

State Geological Survey
  Report on the highways of Maryland, 1899.
  Report on the highways of Maryland with especial reference to the operations of the highway division during 1900 and 1901 (1902).
  Report on the highways of Maryland with especial reference to the operations of the highway division during 1902 and 1903 (1903).
  Report on the Highways of Maryland for the period from January 1, 1904 to May 1, 1905 (1906).
  Report on State highway construction for the period from May 1, 1905 to January 1, 1906 (1906).
  Report on State highway construction for the period from January 1, 1906 to January 1, 1908 (1908).
  Report on State Highway construction for the period from January 1, 1908 to January 1, 1910 (1910).
First, second, third and fourth annual reports of the State Roads Commission for 1908, 1909, 1910, and 1911.
  Progress report for 1912 and 1913.

Massachusetts

State Highway Commission
  Annual report 1892. Economics of Massachusetts roads.
  Table showing mileage of pavements. Road machinery and cost of same. Article on road materials of Massachusetts regarding construction of highways. Statistics showing area, roads, valuations, appropriations, and population with percentages regarding tax and valuation.
  Annual report, 1893. In House documents 1894.
  Annual reports, 1894 to 1904. In public documents, vol. 12.
  Annual report, 1894. Analysis of costs of crushed stone.
  Annual report, 1896. Laboratory experiments on road building stones.
  Annual report, 1896-1898. Tables showing quantities of work done on each road since 1894 and total cost of same.
  Annual report, 1899. Instructions of highway commission to engineers; approved March 30, 1899. Road materials and their physical properties.
  Annual reports, first to twentieth, 1893 to 1911-12.
Highway Association Journal
  Volume 1, nos. 2 to 4.
  Volume 2, nos. 1 to 4.
  Volume 3, nos. 1, 3 and 4.
  Volume 4, nos. 1 and 2.
  November 1907-08.

June 1910-11.
Proceedings.
Annual report, 1909. Traffic census.
Annual report, 1912. Traffic census on State highways, etc.
Report, 1912. Knowledge of traffic a prerequisite to selection of pavement.
Annual report, 1913. French and English costs, road building and maintenance.
Annual reports 1906 to 1913. Automobile regulations, etc.
Annual Reports 1907 to 1913. Telephone investigations, rates, etc.

State Board of Agriculture
- Annual report 1900. Better roads for Massachusetts.
- Prize essays on roads and road making. 1870.

State Board of Education
- Annual report 1902. Comments on cost of conveyance of children to and from schools.

State Library
- Extracts from public hearings given during 1892 in various counties of State regarding width of wagon tires.

Boston Public Library
- Preliminary report of the highway commission.

State Legislature
- Senate document 164, 1875. Report of Board of Agriculture on most suitable width of rims of wheels of loaded wagons.
- House document 253, 1880. Report on subject of "broad rimmed wheels."

Michigan

State Highway Department
- Biennial reports 1905-06 to 1911-12.
- Bulletin 1. Care of earth roads, 1910. F. F. Rogers.
- Bulletin 2. Gravel roads, 1911. F. F. Rogers.
- Bulletin 3. The county road system, 1911. F. G. Randall. (out of print.)
- Bulletin 4. Macadam roads, 1912. F. F. Rogers.
- Circular discussing the county road system, 1914. F. F. Rogers.
- Supplementary annual report, 1913. F. F. Rogers.

Minnesota

State Highway Commission
- Reports 1 to 4, 1905-07 to 1909-10, 1911.
- Bulletin 1. Construction and maintenance of earth roads. G. W. Cooley.
- Bulletin 2. Rules and regulations of State highway department of Minnesota.
- Bulletin 3. Rules and regulations of State highway department of Minnesota.
- Bulletin 4. Better roads for Minnesota. Address by Hon. Logan Waller Page.
- Bulletin 5. Additional rules and regulations for the construction and improvement of State roads.
- Bulletin 6. Report of the State highway engineer on highway systems of foreign countries.
- Bulletin 7. Additional rules and regulations for the construction of State roads and bridges.
- Bulletin 8. Specifications for Roads and Culverts.

Bulletin 9. Specifications for Bridges.
Circular 1. Preliminary information.
Circular 2. Highway commission law, chapter 163, General Laws 1905.
Circular 3. Partial digest of the laws pertaining to the highway commission and expenditures of the State aid funds.
Circular 4. Special report to senate for 1912 road work.
Circular 5. Method of procedure for establishment of State rural highways.
Circular 6. Opinion of attorney general regarding expense accounts of assistant engineers.
Bulletin 10. Additional rules and regulations for construction of State roads.
Bulletin 11. Specification for metal culverts.

Mississippi

Mississippi Agricultural Experiment Station
  Bulletin 67, 1901. Good dirt roads for Mississippi.
Department of Agriculture and Commerce
  Bulletin, vol. 2, no. 3. Road construction and maintenance.

Missouri

Quite a list of publications is reported by the State highway engineer, covering all that have been issued in the State, but, as all of the publications are out of print, none are listed.

Montana

Montana Goods Roads Convention
  Minutes of proceedings, Billings, Mont., 1910.
State Office of Farmers' Institutes
  Montana Farmers' Bulletin 2. Better roads.
Montana Highway Commission
  Specifications for maps and surveys, 1914.
Montana Highway Commission
  Road Pamphlet 1. Road Drag, 1914.
  Montana Road Pamphlet 2. Drainage.

Nebraska

State University. Agricultural Experiment Station
  Press Bulletins. No. 33. Construction and use of the road drag. L. W. Chase.

Nevada

State Engineer
  Biennial reports, 1903-04 to 1911-12.

New Hampshire

State Engineer
  Biennial reports of the governor and council, and of the State engineer relative to highway improvements, 1905-06 to 1911-12.
Agricultural Experiment Station
  Bulletin 30. Experiments in road making. C. H. Pettee.
  Bulletin 46. Road construction and maintenance in New Hampshire.
  Bulletin 77. Road construction in New Hampshire.

State Legislature. House
Journal, 1893. Report of committee on roads, bridges, and canals accompanying joint resolution for appropriation for highways.
State Board of Agriculture
Making and repairing roads. M. Humphrey, 1872.
Annual report, 1894–96. Proceedings of first good roads convention.
State Bureau of Labor
Biennial report, fourth, 1901–02. New Hampshire highway statistics with tables showing by town and county, taxes assessed for all purposes, amount expended on highways, amount expended for repairing of highways in summer, amount expended in breaking roads in winter, number of miles of highway, daily wages, etc.
State Engineer
Biennial Report 1905–06 to 1909–10.
Biennial Report State Superintendent of Highways 1911–12.

New Jersey

Commissioner of Public Roads
Annual reports, 1894 to 1913.
Agricultural Experiment Station
Report for 1901. Road construction.

New Mexico

Territorial Engineer
Second biennial report to the governor. Construction of good roads, p. 165. Cost of road construction, p. 176.
State Engineer
Third biennial report, 1911, 1912.
State Roads Commission
Annual report, 1912.

New York

State Department of Highways
Proceedings of the first to third semi-annual conference of the State commission and county superintendents of highways of the State of New York, 1909, 10.
State Department of Highways. Bureau of Research
Annual Report, 1909, 10. Two volumes.
State Commission of Highways
Reports, 1909, 1910, 1911, 1912.
State Commission of Highways. Bureau of Town Highways
Bulletin 1. Practical suggestions and directions to highway officials relating to construction and improvement, repair and maintenance of town highways and bridges. F. D. Lyon.
State Engineer and Surveyor
Annual report, 1899. History of road improvements during year; arranged by roads.
Annual report, 1899. Engineer's suggestions regarding employment of prison labor to improve public highways of State.
Annual Reports, 1901, 02. Suggestions regarding improvement of various State highways funded by means of issuing State bonds bearing interest and to be redeemed in course of seventeen years from issue.
Annual reports, 1902, 03. Proceedings of third and fourth annual good roads convention of board of supervisors of New York State held at Albany.
Annual reports, 1902, 03. Compilation of laws for improvement of public highways.

Annual reports, 1904, 1905, 1906, 1907, 1908.
Bulletin 1. Improvement of public highways (1899).
Bulletin 2. Improvement of public highways (1899).
Bulletin 3. Improvement of public highways. Instructions for obtaining State aid in the improvement of public highways (1901).
Bulletin 4. Issued by U. S. Department of Agriculture as Public Roads Inquiries Bulletin 22.
Bulletin 5. Proceedings of fourth annual supervisors' highway convention of State of New York (1903).
Bulletin 6. Proceedings of fifth annual supervisors' highway convention of State of New York (1904).
Bulletin 7. Improvement, repair and maintenance of public highways (1904).
Bulletin 8. Comparison of progress during period in which the State aid law has been in operation in New York State (1905).
Bulletin 9. Proceedings of the sixth annual good roads convention of the board of supervisors of the State of New York (1905).
Bulletin 10. Road Red Book (1905).
Bulletin 11. Comparison of progress during the period in which the State aid law has been in operation in New York State (1906).
Bulletin 12. Road Red Book (1906).
Bulletins 13, 14, 15. Comparisons of progress during operation of State aid law (1907, 1908).

Proceedings fourth to tenth semi-annual conference of State Highway Commission and County Superintendents of Highways.
Location and drainage of highways. Extract from Bulletin 1.
Erection of culverts and shortspan bridges (Directions for). Extract from Bulletin 1.

State Library
Legislature, Bulletins 16, 19-29, 31, 33, 35, and 36. 1902 to 1908.

State Prison Commission
Annual report, third, 1897. Employment of convict labor in building and improving highways.

State Superintendent of Public Instruction
Annual report, 1900. Good roads and good schools.

State Agriculture Society
Annual report, 1896. Good roads.
Annual report, 1897. Necessity for State aid to roads. O. D. Dorner.

State Museum
Bulletin, vol. 4, no. 17. Road materials and road building in New York (1897).

State Senate
Document 26 (1896), vol. 5. Report of special committee on good roads.
Document 27 (1903), vol. 6. Memorial regarding constitutional amendment to enable State to maintain commercial supremacy by development of main highways and issue of bonds to aid in their construction.
Document 74 (1850), vol. 2. Report of secretary of State regarding number and length of plank roads of State.

North Carolina

State Geological and Economic Survey
Bulletin 4. Road materials and road construction of North Carolina 1893. J. A. Holmes and W. Cain.
Economic Papers. 2——Some recent Road Legislation in North Carolina.
5. Highway commission.

Bulletin 1. Recent road legislation in North Carolina.
27. Highway work in North Carolina, 1911.
28. Culverts and small bridges for country roads, 1912.
30. Proceedings of North Carolina Good Roads Association.
32. Public Roads are Public Necessities.
Good Roads Circulars. 1 to 97, 1902–1914.
Biennial Reports, 1909, 1910, 1912.

North Dakota

State Agricultural Experiment Station
Reports for 1896. Coal and wood ashes for drive-ways and walks.
State Engineer
Biennial reports, first to fifth, 1910–12.
Bulletin on highway laws of State, 1912.

Ohio

State Highway Department
Annual reports from 1905.
Bulletin 1. Preliminary instructions and forms. Sam Houston.
Bulletin 2. Construction of country roads. Sam Houston.
Bulletin 3. Maintenance of country roads. Sam Houston.
Bulletin 4. State supervision and State aid. Sam Houston.
Bulletin 5. Convict labor for road improvement. Sam Houston.
Bulletin 6. Condition and cost of country roads in Ohio.
Bulletin 7. Revised instructions and forms. Sam Houston.
Bulletin 8. Road laws of Ohio (exhausted).
Bulletin 9. Proposed amended State aid law. Sam Houston.
Bulletin 10. Road laws of Ohio. Exhausted.
Bulletin 11. Highway maps of the counties of Ohio (exhausted).
Bulletin 12. Report of experiments to determine the comparative value of various road binding materials.
Bulletin 13. Supplemental report of Nelson Avenue experimental road and report of experiments in binding gravel and crushed gravel with tar and asphalt, and also in constructing a waterbound road of gravel.
Bulletin 14. An act creating a State highway department and providing aid in construction and maintenance of highways (supply Exhausted but a revised copy in hands of printer.)
Bulletin 15. Supplemental report No. 2 on Nelson Avenue experimental road and supplemental report No. 1 on experimental road in Darke County.
Bulletin 16. The effect of wagon roads.
Bulletin 17. Earth roads.
Bulletin 18. A review of the work of the State highway department.
Bulletin 19. South High Street experimental road (preliminary issue).
Bulletin 20. Instructions for dragging roads and road dragging laws.
Bulletin 21. Legislation pertaining to the construction, improvement, maintenance and repair of roads and bridges by the State highway department and an act providing for a levy and designating the main market roads.

Oklahoma

State Agricultural Experiment Station
Bulletin 21. Road making and repairing. 1896.
State Geological Survey
Bulletin 2. Preliminary report on rock asphalt, asphaltic petroleum, and natural gas in Oklahoma. 1911.

Bulletin 7. Preliminary report on the clays and clay industries of Oklahoma. 1911.
Bulletin 8. Preliminary report on the road materials and road conditions of Oklahoma. L. C. Snider. 1911.

State Department of Highways
Bulletin 1. Concrete culverts and bridges.
Bulletin 2. Metal culverts.
Biennial report, 1911, 1912.

Oregon

State Engineer
Biennial Reports. 1905–06 to 1911–12.

State Agricultural College. Department of Geology and Mining Engineering.
Bulletin 1. Road materials in the Williamette Valley. H. M. Parks. 1911.
Bulletin 2. Highway improvement—earth roads and culverts. E. F. Ayers.

State University
Bulletin, vol. 2, no. 2. Tendencies in recent American road legislation. F. G. Young.
Bulletin, vol. 9, no. 5. The economics of the Oregon good roads problem, 1912. F. G. Young.
Bulletin, vol. 10, no. 5, Concrete Roads vs. Macadam, E. H. McAllister.

Pennsylvania

State Highway Department
Annual reports from 1904.
Bulletin 1. Supervisors and their duties.

State Department of Agriculture
Bulletin 15. Good roads for Pennsylvania, 1896.
Bulletin 66. Pennsylvania road statistics by townships. John Hamilton.
Bulletin 69. The road making materials of Pennsylvania. M. C. Ihlsing.
Bulletin 121. Address of Hon. J. W. Hunter, State highway commissioner.

Rhode Island

State Commissioner of Highways
Annual reports, 1895–96, to 1896–97.

State Board of Public Roads
Annual reports from 1902.

State Board of Agriculture
Annual Report, 1899. Advantages of State aid to farmers. W. W. Armstrong.

State General Assembly
Report of the joint committee to examine into the condition of roads and public highways of the State, 1895.

South Carolina

State Superintendent of Public Works
Report, 1832.

State Agricultural Experiment Station. Clemson Agricultural College
Bulletin 48. Broad and narrow tires.

Handbook of South Carolina issued by Department of Agriculture, Commerce and Immigration, 1908.
Commissioner of Agriculture, Commerce and Industries Reports for the years of 1909, 1910, 1911, 1912 and 1913.
  The economic value of good roads, 1910.
Bulletin. Good roads—How to build and maintain them. M. Goode Homes, C.E., University of South Carolina, January, 1912.
  Route books, 5 vols. 1912.

South Dakota

State Engineer
  Reports, first to fourth; 1906 to 1911–12.
  Bulletin 3. Good roads, 1912.
  Report of State highway commission to the governor for last six months, 1913 (just out).

Tennessee

State Highway Commission
  Special message of Governor Malcolm R. Patterson to the 57th General Assembly, January, 1911.
State Agricultural Experiment Station
  Bulletin, vol. 3, no. 3, 1890. Road construction.

Texas

State University—Mineral Survey
  Bulletins, 1901 to 1904. Nine volumes. 1. Texas petroleum, 1901. 3. Coal, lignite and asphalt rocks, 1902.

Utah

State Road Commission
  First biennial report, 1909–10.
  Second biennial report, 1911–12.
  Road laws of the State, 1909.
  Road and highway laws, 1912.
State University—State School of Mines
  Bulletin 2. Tests of macadam rock.
  Bulletin 3. Construction and maintenance of earth roads.
  Bulletin 4. Economical design of reinforced concrete.
State Engineer
  Fourth biennial report, 1903–04.
  Fifth bienniel report, 1905–06.
  Sixth biennial report, 1907–08.
  Seventh biennial report, 1909–10.
  Eighth biennial report, 1911–12.

Vermont

State Highway Commissioner
  Reports, first to seventh; 1899–1900 to 1911–12.
State Board of Agriculture.
  Biennial Report, second, 1873–74. Highways. A. B. Halbert.
State Legislature—Senate
  Journal 1855. Report of committee on roads.

Virginia

State Agricultural Experiment Station
  Bulletin 34, 1893. Road improvement.
State Highway Commissioner
  Annual Reports, first to seventh; 1906-07 to 1910-11, 1912, 1913.
State Board of Public Works
  Reports, 1816, 1818, 1819-20, 1823 to 1847, 1849 to 1855, 1866 to 1876.

Washington

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  Bulletin 1. State and county road laws by legislature of 1907.
  Bulletin 2. Report to Governor of Washington on convict labor on State roads.
  Bulletin 3. State aid roads.
  State investigating committee, highway department. Report of the board of control on State rock crushing plants; working convicts on State roads and at crushing plants.
  Biennial reports, 1906, 1908, 1910, 1912.
State Agricultural Experiment Station
  Bulletin 39, 1899. Road improvement.
State Geological Survey
  Bulletin 2. The road materials of Washington.

West Virginia

State Highway Inspector
  Partial report, 1908.
State Department of Public Roads
  Biennial Report, first, 1909-10.
  Circular, September, 1909. Construction and use of split-log drag.
  Circular, August, 1910.
  Circular, September, 1910.
  Circular, October, 1910.
  Bulletin 1. Road drags, their construction and use. H. E. Williams.
  Bulletin 2. To the county road engineers.
  Bulletin 3. Opinion of the attorney general in regard to the road and bridge funds of West Virginia.
  State road map, 1911.
  Bulletin 1. Road law, July, 1913.
  Bulletin 2. Road officials, February, 1914. County and State.
  Circular 1. Sign posts.
  Circular 2. Rules for testing material.
  Circular 3. Duties county officials.

Wisconsin

State Geological and Natural History Survey
  Road pamphlet, 1907.
  Bulletin 10 (Economic Series 6). Highway construction. 1903.
  Bulletin 18 (Economic Series 11). Rural highways of Wisconsin. W. O. Hotchkiss. 1906.
  Road Pamphlet 1. Earth roads. A. R. Hirst. 1907 and 1909.
  Road Pamphlet 2. Earth road drag. A. R. Hirst.
  Road Pamphlet 3. Stone and gravel roads. A. R. Hirst.
  Road Pamphlet 4. Culverts and bridges. A. R. Hirst.
  Road Pamphlet 5. First biennial report of the Highway Division.

State Agricultural Experiment Station
Report for 1902. Road construction in Wisconsin.
Report for 1903. Road construction and maintenance.
Bulletin 79, 1899. Road construction and maintenance.
State Highway Commission
Bulletin 1. The new State and highway law, chapter 337, Laws 1911.
Bulletin 2. Instructions to county highway commissioners and foreman for building State aid roads.
Bulletin 3. The amended State highway law, chapter 668, laws 1913.
First preliminary biennial report, 1912.

Wyoming

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Congressional Joint Committee on Federal Aid in the Construction of Post Roads
Preliminary report, January 14, 1913.

American Highway Association

Good Roads Year Book of the United States, 1912, 1913 and 1914.
Addresses, Papers and Resolutions, American Road Congress, 1911, 1912 and 1913.
Good Roads Year Book, 1912, $1.00.
Good Roads Year Book, 1913, $1.00.
Good Roads Year Book, 1914, $1.00.
Proceedings of First American Road Congress, $1.00. (Held in Richmond, Virginia, November 20–23, 1911.)
Proceedings of Second American Road Congress, $1.00. (Held in Atlantic City, N. J., September 30–October 5, 1912.)
Proceedings of the Third American Road Congress, $1.00. (Held in Detroit Michigan, September 29–October 4, 1913.) Will be published in next few months.
List of Road, Street and Other Officials Attending American Road Congress at Detroit, September 29–October 4, 1913, $3.00. This list contains names, official titles, and addresses of over 2000 persons.

Bulletins, price 10 cents

Bulletin 1. The relation of the contractor to the public official. C. A. Crane, secretary, The General Contractors' Association.
Bulletin 2. Modern methods of road surface preservation by bituminous preparations. Chas. W. Ross, superintendent of streets, Newton, Mass.
Bulletin 3. Bond issues for road improvement. Hon. Lee McClung, treasurer of the United States.
Bulletin 4. Good roads and the cost of living. W. W. Finley, president, Southern Railway Company.
Bulletin 5. Earth, sand-clay and similar materials, qualities and methods of application. W. S. Keller, State highway engineer of Alabama.
Bulletin 6. Street pavements: their selection, care and maintenance. By Geo. W. Tillson, consulting engineer to the borough president, Borough of Brooklyn, New York City.
Bulletin 7. Road administration. By Col. W. D. Sohier, chairman of the Massachusetts State Highway Commission.
Bulletin 8. The labor problem in road construction. By P. St. J. Wilson, State highway commissioner of Virginia.
Bulletin 9. Bond issues for road improvement. By S. E. Bradt, member Illinois State highway department.

Bulletin 10. Systematising the purchase of road materials and equipment. By Henry G. Shirley, chief engineer, State roads commission of Maryland.

Bulletin 11. Highway accounting, with special reference to maintenance. By Halbert P. Gillette, M. Am. Soc. C. E., chief editor of "Engineering and Contracting."

Bulletin 12. Unsurfaced roads. By W. S. Keller, State highway engineer of Alabama.

Bulletin 13. The protection and upkeep of road equipment. By Daniel J. Hauer, construction economist and consulting engineer.

Bulletin 14. Waterway structures. By A. R. Hirst, State highway engineer of Wisconsin.

Bulletin 15. Legal suggestions respecting road contracts. By William Law Bowman, C. E., LL. B., New York Bar.

Bulletin 16. Treatment of worn out and ravelled macadam surfaces. Address of Col. E. A. Stevens, State highway commissioner of New Jersey.

Bulletin 17. The selection of materials for macadam roads. By Logan Waller Page, director U. S. Office of Public Roads.

Bulletin 18. Concrete roads. By Hon. Frank F. Rogers, State highway commissioner of Michigan.

Bulletin 19. Bituminous construction. By S. D. Foster, chief engineer Pennsylvania State highway commission.

Note.—All publications are sent free to members of the association. The annual dues for membership are $5.00, and cover a period of twelve months from date of payment. Remittance for either dues or publications should be made to Lee McClung, treasurer.

Road Periodicals

The American City. $2.00 per year. Monthly. Published by The Civic Press, 93 Nassau Street, New York City.

Annales des Ponts et Chaussees. 45 francs a year. Bi-monthly. Published by Ecole Nationale des Ponts et Chaussees, 28 Rue des Saints-Peres, Paris, France.

Better Roads. $1.00 per year. Monthly Published by U. B. Publishing House, Jesse Taylor, Editor, Dayton, Ohio.

The Bulletin. $1.00 per year. Monthly. Published by the General Contractors Association, 51 Chambers Street, New York City.

Canadian Engineer. $3.00 per year. Weekly. Published by Monetary Times Printing Company, Ltd., James J. Salmond, Managing Editor, Toronto, Canada.

Cement and Engineering News. $2.00 per year. Monthly. Published by William Seafert, Editor, 22 Fifth Avenue, Chicago Illinois.

Cement Era. 50 cents per year, three years $1.00. Monthly. Published by Cement Era Publishing Company, 1207 Morton Building, Chicago, Illinois.

Cement World. $1.00 per year. Monthly. Published by Cement World Company, 241 Fifth Avenue, Chicago, Illinois.

Concrete-Cement Age. $1.50 per year. Monthly. Published by Concrete-Cement Age Publishing Company, 97 Fort Street West, Detroit, Michigan.

Contractor. $1.00 per year. Semi-monthly. Published by E. H. Baumgartner, 842 Monadnock Block, Chicago, Illinois.

Engineering and Contracting. $2.00 per year. Weekly. Published by Myron C. Clark Publishing Company, 608 S. Dearborn Street, Chicago, Illinois.

Engineering News. $5.00 per year. Weekly. Published by Engineering News Publishing Company, 505 Pearl Street, New York City.

Engineering Record. $3.00 per year. Weekly. Published by McGraw Publishing Company, 239 West 39th Street, New York City.

Good Roads. $2.00 per year. Weekly. Published by E. L. Powers Company, 150 Nassau Street, New York City.

Kansas Good Roads Advocate. 50 cents per year. Monthly. Published by the Kansas State Good Roads Association.

Manufacturers Record $4.00 per year. Weekly. Published by Manufacturers Record Publishing Company, Baltimore, Maryland.

Michigan Roads and Forests. $1.00 per year. Monthly. Published by the State Review Publishing Company, 70 Larned Street West, Detroit, Michigan.

Municipal Engineering. $2.00 per year. Monthly. Published by Municipal Engineering Company, Charles C. Brown, Editor, Indianapolis, Indiana.

Municipal Journal. $3.00 per year. Weekly. Published by Municipal Journal and Engineer, Inc., 50 Union Square, New York City.

Pacific Builder and Engineer. $5.00 per year. Weekly. Published by Fuller Publishing Company, Pacific Building, Seattle, Washington.

The Road Maker. $1.00 per year. Monthly. Joe L. Long, Publisher, Des Moines, Iowa.

Rock Products. $1.00 per year. Monthly. Published by The Francis Publishing Company, 537 South Dearborn Street, Chicago, Illinois.

Southern Good Roads. $1.00 per year. Monthly. Published by Southern Good Roads Publishing Company, Lexington, North Carolina.

The Surveyor. 32 s. per year. Weekly. Published by St. Bride's Press, Ltd., 24 Bride Lane, Fleet-Street, London, E. C. ,England.

Zeitschrift fur Transportwesen und Strassenbau. 24 marks per year. Issued three times a month. Published by Julius Englemann, Berlin W. 35, Lutsowstr. 97, Germany.

REFERENCE LIST OF PAPERS, ADDRESSES AND MAGAZINE ARTICLES PUBLISHED IN 1913

Papers Presented at Third American Road Congress, Detroit, Michigan, 1913

Published by the American Highway Association

Federal aid in road construction. By David F. Houston, Secretary of Agriculture. (Apportionment of aid—States as road units.)

Sand-clay road maintenance in North and South Carolina. By Leonard Tufts. (Comparison of maintenance costs with maintenance of more expensive types—explanation of methods.)

Gravel roads—construction and maintenance. By S. P. Hooker. (Construction—cost—special treatment—maintenance-100-mile units for patrol.)

Highway accounting, with special reference to maintenance. By H. P. Gillette. (Need for itemized accounts of highway property—maintenance signifies repairs and renewals—suggestion for a property account for roads—should be two sets of ledgers, maintenance and construction—need for detailed unit cost-keeping.)

Legal suggestions of importance to road contractors. By W. L. Bowman. (Contracts—satisfaction clauses—contract work—duties of the engineer—construction of contracts—repairs.)

Financing road improvement. By William G. Edens. (Thorough investigation of types of road urged—federal aid, convict labor, centralising legislation in Illinois analysed.)

Labor problem in road construction. By P. St. J. Wilson. (Funds available in counties—convict labor—cost of convict labor.)

Merit system in road management. By J. T. Doyle. (Civil service appointments.)

Bituminous construction. By S. D. Foster. (Methods of construction followed by Pennsylvania State highway department—selection of material—binders—durability.)

Lessons from the International Road Congress. By Col. Wm. D. Sohier. (New streets and roads—money for new roads—roads in France—drainage ditches—English roads—maintenance—resurfacing—character of English tars.)

Bond issues for road improvement. By S. E. Bradt. (Need for improvement—magnitude of project—permanency of improvement.)

California's $18,000,000 State highway system. By A. B. Fletcher. (Types of work—thin concrete roads, [illegible] inches wearing surface—maintenance.)

Concrete highway construction. By A. N. Johnson. (Preparation of concrete—action under temperature changed—expansion joints—longitudinal cracks and prevention—one and two course construction—curing concrete—thickness of concrete roads—crown—finish—organisation of working force—relative progress of construction—maintenance.)

Concrete roads. By F. F. Rogers. (Present condition of Wayne County roads in detail—construction of each and history maintenance—effect of subgrade defects.)

Convict labor in highway construction. By Joseph Hyde Pratt. (Due return to society—road work best work for convict—healthy—publicity does not have bad influence—permits permanently organized force better than with free labor—frees community from tramps—results beneficial in road improvement—teaches convict useful occupation—honor system wide spread.)

Roads of Allegheny County, Pennsylvania. By J. S. Gillespie. (Asphaltic concrete roads carry heavy traffic for three years with no expense for repairs—old macadam base—brick pavements—patrol system of highway maintenance.)

Essential features in good brick road construction. By Jas. M. McCleary. (Work of Cuyahoga Company, Ohio—drainage—curbs—sand cushion—laying of brick—rolling—filling joints.)

Park drives and boulevards. By Linn White. (Intense traffic in Chicago—asphaltic pavement—cross section views—asphaltic mixing plant—plant foreman's report—surface crew—square yards laid—proper setting.)

Protection and upkeep of road equipment. By D. J. Hauer. (Small contracts increase cost of equipment—best materials cheapest in long run—machinery should be protected when not in use.)

Selection of road materials. By L. W. Page. (Description of machinery for testing road materials, and various tests—value of such tests—road binders and dust preventives.)

Systematizing purchase of road materials and equipments. By H. G. Shirley. (Methods of Maryland State roads commission.)

Unsurfaced roads. By W. S. Keller. (Need for relocation and better grades and drainage only means to improve some roads—need for careful construction of earth roads—use of drag for maintenance—use of statute labor in Southern United States for maintaining roads.)

Treatment of raveled macadam. By E. A. Stevens. (Ravelling due to improper construction, overload and neglect—importance of fixed as well as operating charges—methods of treatment.)

Waterway structures. By A. R. Hirst. (Need for drainage structures—work in Wisconsin—classification of bridges in Wisconsin by length of spans—foundations.)

Magazine Articles[1]

FROM "BETTER ROADS"

January, 1913

Organization of a State highway department. By Maj. W. W. Crosby. Pp. 60–64. Essentials in formation of a State highway department, State commission of three is best, chief engineer also needed and two assistant engineers.)

Story of Cumberland and United States Road or National Pike. By Morris Schaff. Pp. 64–68. Historical essay. Illus.)

February, 1913

Story of Cumberland and United States Road or National Pike (continued). By Morris Schaff. Pp. 36–39. (Historical essay.)

Development of a State system of highways. By Jas. R. Marker. Pp. 40–46. (Work in Ohio: Legislation, method of selecting roads to be improved—State aid—types of roads.)

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[1] In the preparation of this reference list the Editor was much indebted to Mr. W. W. Sniffin, Librarian, United States Office of Public Roads, for valuable assistance.

Why every State should adopt the Highway Commission and State aid plan. By L. W. Page. Pp. 46–51. (Historical review of State aid in United States—waste of road appropriations in Louisiana—State aid gives equitable distribution of road taxation from automobiles—State aid means expert supervision—abolition of labor tax recommended.)

History of Cumberland Road. Pp. 55–59. (Address by Judge J. M. Lowe.)

March, 1913

Argument by Senator Swanson in favor of House Bill 8003. Pp. 26–27. (Provides for federal aid in improvement and maintenance—initiative rests with State or locality—national government pays one-half—distribution is one-half on ratio of population of State to total population and one-half on ratio of star routes or rural delivery routes in State to total in United States—no State to receive less than $100,000.)

National Old Trails Road, Ocean to Ocean—H. R. Bill 28188. Pp. 28–29. (Provides for road from Washington, D. C. to California over several historic roads and trails.)

Shackleford Roads Bill. Pp. 29. (Federal aid—provides classification of roads according to grades, length, topography, surface material, width, etc.)

Observations on inter-county State aid system for Illinois. By Chas. D. Stilwell. Pp. 42–45. (Example given of work in Saline County townships—condemnation of hard roads law of Illinois—cost of inter-county roads—Springer bill providing for bond issues, etc.)

Ohio State University winter course in highway engineering. Pp. 46–47. (Catalogue of courses given.)

May, 1913

Convict labor on Colorado roads. Pp. 31–32. (Large mileage of roads built at small cost.)

Lifting Ohio out of the mud. Pp. 34–46. (Work of Ohio Good Roads Federation—Hudson-Hite bill—amount of money needed—Portage County plan—road drag law—road materials by prison labor—codification of Ohio road laws—State highway law as amended, April 19, 1913.)

Brick roads, material, construction and maintenance. By Theodore A. Randall. Pp. 47–51. (Brick pavements cheapest ultimately—no excuse for poor work—comparison between different sections of brick roads—New York's splendid brick roads—reasons for superiority of brick roads—brick roads dustless.)

June, 1913

Commercial organizations and public roads—By G. Grosvenor Dawe. Pp. 11–13. (Commercial organizations helping cause of good roads—examples from different localities.)

Glutrin. By W. M. Whitelaw. Pp. 16–20. (Brief description of road binders—effect of glutrin on road materials.)

National highways. By Chas. H. Davis. Pp. 30–35. (Argument for federal aid.)

Bituminous materials for road building. By Allerton S. Cushman. Pp. 35–36. (Discussion of types and specifications.)

Some features of macadam construction. By T. R. Agg. Pp. 37–38. (Size of road materials—screenings—advantages in bituminous macadam roads—method of construction—binders.)

Distillation of tars, methods of determination and value in specifications. Pp. 38–41. (Sources of variation in distillation—distillation of creosote—distillation tests—comparison of refined tars—specifications, Massachusetts, New York, England, etc.)

Specifications for patented pavements. Pp. 43–47. (Sample proposal or bid—bituminous pavements—amiesite—filbertine—warrenite.)
Petrographic study of road building rocks in Office of Public Roads. Pp. 47–49. (Analysis of inorganic road material—classification of material—general classification of rocks for road making—mineral constituents of rocks used for road making.)
Mixing plants used in construction of the Topeka bituminous concrete pavements of Borough of Queens in 1912. By A. F. Gruenthal. Pp. 49–51. (Description of contracts let and various plants.)
Location and relocation of roads. By Wm. J. Roberts. Pp. 53–54. (Grades—alignment.)

July, 1913

Prospective opportunities for highway engineers in a National highways department. By Chas. H. Davis. Pp. 26. (Statement of improved roads compared with unimproved.)
Consistency of bituminous materials—its determination and value in specifications. Pp. 32–35. (Description of machinery and tests.)
Fixed carbon in bituminous materials—its determination and value in specifications. Pp. 37–40. (Methods of determining presence and calculations for amounts—value of fixed carbon—characteristics.)
Methods for testing toughness of bituminous materials. Pp. 40–41.
Bituminous gravel concrete pavements. Pp. 41–45.
History of tar-concrete pavements in Ontario. By W. A. McLean. Pp. 45–48.)

August, 1913

Third International Road Congress. London, 1913. By Henry B. Drowne. Pp. 44–51. (Bridge surfaces, plank, wood block, sheet asphalt, stone block, brick, concrete, etc.—bituminous surfaces and pavements constructed by mixing method.)

September, 1913.

Cumberland Road in Congress in 1829. Pp. 42–43. (Historical essay.)
Third International Road Congress. London, 1913. By Arthur H. Blanchard. Pp. 43–45. (Discussion of work of the Congress.)
Earth roads. By A. N. Johnson. Pp. 50–53. Better earth roads possible—principles of construction—best methods require a little work done often—necessity for dragging at all seasons.)
Historic places along Old National Pike, west of Zanesville, Ohio. Pp. 53–56. (Mostly illustrations.)
Road conditions in Illinois. Pp. 57–63. (Road legislation—new State aid law.)

October, 1913

Needs of Pennsylvania highways. By Chas. E. Foote. Pp. 43–44. (Need of bond issue and immediate work.)
Discussion of patents on bituminous concrete pavement. By Warren Brothers Company. Pp. 52–55.
Traffic and roads. By Col. Wm. D. Sohier. Pp. 55–58. (Economic hauling necessary—traffic indicates kind of road required—traffic censuses in Massachusetts—methods of tabulating—attractive scenery made accessible by good roads—weight of traffic—narrow tires.)
Road conditions in Illinois (continued.) Pp. 59–64. (Road legislation—State aid.)

November, 1913

American Road Congress, Detroit, 1913. Pp. 14. (Resolutions adopted.)
Cross Alaska in motor truck. Pp. 18–19. (Expedition by United States army engineers.)

Bond issues for road improvement. Pp. 21–23. (Care required in making bond issues—need for immediate road improvement—vast amount of money required.)

December, 1913

Road conditions in Louisiana. Pp. 5–9,56. (Forms of State aid, monetary, convict, road outfit, force account—roads to be improved—road legislation, State aid.)

Highways of Europe. By John C. Nicholson. P. 10. (Conditions of traffic—roads in France and Switzerland.)

Embankment in road construction. By George C. Warren. Pp. 14–15, 56, 58. (Proper and improper settlement.)

Digest of state road laws in Massachusetts. By Col. Wm. D. Sohier. Pp. 20.

International Road Congress, London, 1913. Pp. 28–29. (Roads in Europe—cost of road systems.)

FROM "CANADIAN ENGINEER"

January, 2, 1913

Specifications for various pavements. Pp. 103–106. (Brick on concrete foundation—rocmac—waterbound macadam.)

Bituminous pavements for city streets. By Geo. W. Tillson. Pp. 108–109. (Type of asphalts used—construction of pavement—maintenance and repair—life of asphalt pavements—asphalt block pavements.)

January 9, 1913

Oil for macadam roads. Pp. 158.

Costs of macadam roads of different thicknesses. Pp. 159–160. (Tables showing costs of roads, 5, 6, 7, 8, 9 and 10 inches thick.)

February 20, 1913

Asphaltic concrete and sheet asphalt pavements. Pp. 350–352. (Specifications adopted by Vancouver, British Columbia.)

February 27, 1913.

Brick pavements for country roads. By Wm. C. Perkins. Pp. 367–370. (Roads in New York State.)

March 6, 1913

Plant equipment. By F. E. Ellis. Pp. 390–392. (Machines and tools used in highway engineering.)

Some features of macadam construction. By T. R. Agg. Pp. 397–402. (Requisites for good construction—stone, rolling, gravel bond, foundation, screenings, binder, durability of water-bound-macadam, etc.)

March 13, 1913

Bascule bridges. Pp. 419–423. (Early French bascules—Belidor and Delill's construction—J. C. Ardagh—Derché system—Poncelet system—revolving arch with bascule floor—suspended series of falling counterweights—revival of Poncelet system.)

Repair and maintenance of roads. By Dr. L. I. Hewes. Pp. 424–426. (Need for greater centralisation in roads—use of statute labor to be condemned—county road system should be carefully planned—order of improvement of roads defined—need for systematic set of highway accounts—method of maintaining earth roads—use of drag—maintenance of macadam, gravel and bituminous-macadam roads—need for skilled engineers.)

Road construction course at University of Toronto. Pp. 428.

Earth and gravel roads. By Robert C. Terrell. Pp. 432-434. (Method of construction—location—roads in Kentucky.)

March 20 1913

Road construction. By W. A. McLean. Pp. 458-460. Materials—road classification—trunk roads—county or main market roads—township roads—binder—coursing stone—gravel roads—methods of construction—rolling.)

March 27, 1913

Portland cement tests. By Max Gary. Pp. 485-486. Accelerated tests in France.)

April 10, 1913

Road metals. By W. A. McLean. Pp. 551-552. (Distributing power—depth of materials—water-proofing—method of placing stone—durablity under wear—quality of stone.)

Costs of concrete pavement. Pp. 558. (Table of costs of pavements in various cities of United States.)

May 1, 1913

Costs of concrete pavements. By C. M. Boynton. Pp. 655-656. (Material costs of one and two course work—Wayne County roads.)

Usefulness of county engineers. Pp. 663-666. (Types of poor bridge and culvert construction.)

Limitations of bituminous carpet surfaces. By A. W. Dean. Pp. 668-669. (Character of road crust—character of carpet itself—character of traffic.)

May 22, 1913

Tests—loading until breaking point of a 100-foot arch bridge. By V. L. Elmont. Pp. 739-744. (Test of exhibition bridge at Dusseldorf, Germany.)

Concrete culverts for country roads, by N. Carolina Geological and Economical survey. Pp. 758-761. (Concrete waterways—cost of concrete and labor-material laid down at culvert.)

June 5, 1913

Concrete culverts. By F. H. McKechnie. Pp. 822-827. (Waterway area—placing the culvert—foundation bed and foundations—typical specifications for concrete structures—materials—proportioning materials (gravel concrete, broken stone concrete) types of concrete culverts in common use—concrete pipe culverts—distributed vertical load—distributed vertical and horizontal load—oblique load—resisting moments and stresses.)

June 12, 1913

Concrete culverts. By F. H. McKechnie (continued.) Pp. 859-863. Old rail culverts—T-beam culverts—box culverts—design of arch culverts—reinforcing of culverts—costs of culvert construction.)

June 26, 1913

Highway construction with paint binder and its sheet asphalt surface. By A. E. Loder. Pp. 908-909. (Description of road constructed in California by State highway department.)

July 3, 1913

Conclusions regarding macadam road construction. Pp. 108–111. Thickness and width—waterbound macadam—bituminous-macadam—estimated cost of one mile of macadam road—analysis of sample tars—construction costs.)

July 10, 1913

Suitable road surfaces for various kinds of traffic. By Wm. D. Sohier. Pp. 135–137. (Motor-vehicle traffic—maintenance costs—bituminous binders and dust layers for old roads—effect of traffic on bituminous surfaces—failure of heavy oils—road failures caused by horse-drawn traffic—hot oil blanket surface—table showing results.)

Road inspection in New Zealand. Pp. 153. (Duties of inspector.)

Macadam roads constructed with tarry, bituminous or asphaltic binders. Pp. 157–160. (Discussion of third International Road Congress—foundation and drainage—sizes and shapes of broken stone for bituminous bound surface crust—use of partially worn materials—various methods of treatment—specifications—cost data.

July 17, 1913

Penetration method in macadam road construction. By W. W. Crosby. Pp. 177–179. (Foundation and drainage—sizes and shapes of broken stone—use of worn materials—thickness of strength crust—use of tar, tarry compounds, asphalt, etc.)

Inter-attrition theory of road wear. Pp. 181–182.

Road resolutions adopted by the 1913, London, Congress. Pp. 189–193. (Deals with various questions discussed at Congress.)

July 24, 1913

Some notes on macadam roads and pavements. By Fred L. Macpherson. Pp. 197–202. (Macadam road construction—effect of speedy vehicles—road treatments—advantage of pavements—width and construction of pavements, brick, concrete—Dollarway—asphaltic mixture pavements.)

August 7, 1913

Opportunities for highway engineering in contractors organizations. By H. B. Pullar. Pp. 264–265. (Greater diversity of work—satisfactory work required—need for student of traffic and economic conditions.)

High pressure spray treatment of road surfaces. By Thos. Aitken. Pp. 280–283. (Effects beneficial penetration—refined tar best for surface spraying because of dust—experiments in Scotland—bituminous-macadam construction.)

Third International Road Congress. By A. H. Blanchard. Pp. 287–289. (Organization of the Permanent Association—various discussions of the 3d Congress.)

August 14, 1913

Drainage as affecting highway traffic. By W. Gregory. Pp. 310–311. (Use of deep side drains.)

August 21, 1913

Determination of international temperature range in concrete arch bridges. By C. S. Nichols and C. B. McCullough in Bull. 30, Iowa State College. Pp. 329. (Yearly range of temperature in Iowa about 80° F.—sunlight influences interior of concrete—shrinkage of concrete—care to be taken to prevent cracks.)

A few comparative costs in road and pavement work. By F. L. Macpherson. Pp. 333–334. (Macadam roads—cost in British Columbia.)

August 28, 1913

Road maintenance in England. By Chas. Vawser. P. 362. Foundations to be solid—cost of construction and maintenance—bituminous roads—value of good roads.)

September 4, 1913

Road maintenance and cost. By H. F. Gullan. Pp. 398–402. (Classification of road surfaces—resurfacing treatment—tar—macadam road, etc.—sett paving on existing foundations—sett paving on concrete foundations—natural asphalt, hardwood and softwood paving—statistics on road construction and maintenance—cleansing road surfaces—cost of maintenance per square yard and cost per mile per annum of 18-foot roadway of various types.)

Street and pavement construction. By A. F. Macallum. Pp. 407–410. (Macadam—asphalt—asphalt block—vitrified brick—stone block—treated wooden blocks—grades.)

September 25, 1913

British Road Board. Pp. 490. (Organisation—purposes—expenditures—policies—income.)

Bituminous-concrete pavements. By W. B. Spencer. Pp. 493–496. (Bituminous-macadam—bituminous-concrete—sheet asphalt—method of construction, specifications, etc.)

October 2, 1913

Financing of road engineering. By Reginald Ryves. Pp. 521–522. (Taxation to be general in sparcely settled districts—countries of varying agricultural conditions require general taxation for road maintenance, example in Great Britain.)

October 9, 1913

Concrete roads in Wayne Co., Michigan. Pp. 553. (Method of construction and cost.)

October 16, 1913

Traffic census in Massachusetts. Pp. 578–580. (Increases and changes in traffic from 1909–1912—weight of traffic—average daily traffic.)

November 13, 1913

Value of the fixed carbon test. By H. B. Pullar. P. 703. (Fact that different methods are used is argument against tests—tests in Ohio show value of method—valuable after so-called natural asphalts have been fluxed with residuum oil.)

November 20, 1915

Fixed carbon text empirical. By L. M. Law. Pp. 738–739. (Adverse criticism of test.)

November 27, 191.

Fixed carbon text. By J. W. Howard. Pp. 780–781. (Fixed carbon test has no relation to finished quality of refined asphlat, asphalt cement or road binder—it is a brand-identifying test.)

December 4, 1913

Fixed carbon depends on crude. By Lester Kirschbraun. Pp. 801–805. Not an indication of cracked oil if crude also has high fixed carbon.)

December 25, 1913

Cost of concrete road. By B. P. Lampert. P. 901. (Labor—material and handling same—tables of items.)

FROM "ENGINEERING AND CONTRACTING"

January 8, 1913

Methods of repairing cement concrete pavements. A. N. Johnson. Pp. 33–34. (Usually made with cement mortar or concrete—concrete pavements in Bellefontaine, Ohio, Bad Axe, Michigan, Wayne County Michigan, etc.)

Cost of object-lesson sand-clay roads constructed in 1911–1912 by the United States Office of Public Roads. Review of Office of Public Roads report for 1912. Pp. 34–36. (Cost and details of construction of 15 sand-clay roads.)

Method of preparing plans and cross sections for road grading. Pp. 36–37.

Distillation of tar; Methods of determination and value in specifications. Pp. 37–39. (Distillation of creosote—sample made from water-gas tar—distillation test (Office of Public Roads, American Society of Civil Engineers, American Railway and Maintenance of Way Association, American Society for Testing Materials)—extract from Massachusetts, Illinois, New York highway commission specifications—extract from specifications of Association for Standardising Paving Specifications.)

Supplementary reports on 1907, 1908, 1909 and 1910 Dust Prevention and Road Preservation experimental work of United States Office of Public Roads. Pp. 39–40. (Review of 1910 progress report of Office of Public Roads.)

January 15, 1913

Oil-cement concrete and bituminous concrete in experimental pavements on Hillsdie Avenue, Queens Borough, New York City. Pp. 61–63. Review of Office of Public Roads Circular giving progress report on Tar and Oil experiments, 1911.)

Method for determining the toughness of bituminous materials. Pp. 64–65. (Work of New York highway commission.)

January 22, 1913

Traffic census as a preliminary to road improvement. By Col. Wm. D. Sohier. Pp. 94–96. (Traffic census in Massachusetts—changes of traffic—width of roadway—effect of traffic on road surfaces—bituminous binders as dust layers—heavy oils—comparison of weights of traffic per yard of width of carriage way—oil surface.)

Value of traffic census in economical design of highways. By Col. Wm. D. Sohier. Pp. 97. (Valuable as guide to design of wearing surfaces of highways.)

Method of making a survey for a high-way improvement. By J. J. Cox. Pp. 97–98.

Design by the method of the ellipse of elasticity. A. C. Janni Pp. 99–103. (Pressure polygon for dead loads—temperature stresses—complete method for the design of the elastic arch—investigation of particular points—investigation of deflection.)

Design of various types of highway bridges from the standpoint of modern traffic. By F. H. Neff. Pp. 104–107. (Modern traffic (weight of trucks, road rollers and traction engines)—speeds, dimensions—effects and requirements of modern traffic—starting and stopping of cars—clearance of bridges and bridge approaches—hand rails—structures affected.)

January 29, 1913.

Method of laying wood block pavements. By H. S. Loud. Pp. 114–115. (Setting curb—grading—concrete base—sand layer—specifications for blocks.)

February 5, 1913

Method and cost of constructing a granitoid pavement in Pierce County, Washington. By C. H. Swettser. Pp. 143–145. (Specifications for granitoid pavement—superelevation of curves.)

Bituminous gravel concrete pavements. By S. J. Stewart. Pp. 145–146. (Method of construction—gravel—costs.)

Petrographic study of road building rocks in United States Office of Public Roads. Pp. 146–148. (Analysis of inorganic road materials—classification of material—physical properties of road materials.)

Rock crushing by convict labor in Washington. Pp. 148–149. (Five rock quarries owned by State—statement of conditions in each.)

Modern road making machinery and its uses. By T. R. Agg. Pp. 150–151. (Kinds of machinery vary with types of roads—discussion of different machines—machines needed for various classes of work.)

Consistency of bituminous material.—Its determination and value in specifications. By W. W. Crosby. Pp. 152–154. (Value and definition of term—machines used in tests—methods of tests.)

February 12, 1913

Some cost data on street paving. By W. W. Kerch. Pp. 170. (Work in Granite City, Illinois.)

Bituminous materials: Their use and misuse. By C. S. Reeve. Pp. 170–171. (Some details in methods of applying bituminous materials.)

Fixed carbon in bituminous materials; Its determination and value in specifications. By L. Kirschbraun. Pp. 172–174. (Considered in connection with other analytical data, fixed carbon test is a valuable test—fixed carbon in bituminous cements with various fluxes—analysis of residual products—effect of character of crude on fixed carbon.)

February 19, 1913

Method and cost of brick paved country road construction in New York State. By Wm. C. Perkins. Pp. 198–199. (Discussion of New York brick work up to 1913.)

Limitations in use of bituminous carpet surfaces. By A. W. Dean. Pp. 200–201. (Limitations governed by character of crust, of carpet itself and traffic.)

February 26, 1913

Relative advantages of laying brick pavements on sand foundations and cement concrete foundations. Pp. 226–227. (Example drawn from streets of Cleveland, Ohio.)

Some conditions affecting the interaction of motor vehicle wheels and road surfaces. By L. I. Hewes. Pp. 228–229. (Relation between speed, effective horsepower and tractive resistance—horizontal velocities with speed of machine at 30 M.P.H.)

Maintenance and repair of asphalt, bithulithic and creosoted wood block pavements. By W. L. Hempelmann. Pp. 115–116. (New procedures for maintenance of pavements.)

Experimental road construction at Chevy Chase, Maryland, by the United States Office of Public Roads. Pp. 116–118. (Review of Office of Public Roads publication.)

Country road construction with small quantities of gravel By G. W. Allyn. Pp. 119. (Methods of construction described.)

March 5, 1913

Curves for determining areas of openings for road culverts and bridges Pp. 255–256. (Illinois Society of Engineers and Surveyors, comparison of results from run-off formulas, and area of openings for drainage area of 10 square miles.)

Simple practical method for determining the stresses in a hingeless elastic arch. By T. J. Wilkerson. Pp. 263–267. (Loading-moduli of elasticity—temperature—determining length of span—floor system—depth of rib—ordinates—dead load—live loads—temperature and rib shortening—details of design—rib reinforcement.)

A reinforced concrete highway bridge with five 161-foot arch spans. (Staff article.) Pp. 267–268. (Constructed across Catawba River, near Charlotte, North Carolina.)

The designing and methods and cost of constructing a flat slab reinforced concrete highway bridge. By E. W. Robinson. Pp. 268–269.

March 12, 1913

Concrete road construction in Milwaukee County, Wisconsin, and in Winona County, Minnesota—O. B. Leland. Pp. 282–283. (Methods and costs of construction—combination concrete and macadam road construction in Winona County, Minnesota.)

Effect of heavy motor traffic on pavements (From *The Surveyor*) Pp. 284–285 (Reports of Metropolitan Paving Committee of London, England, received from various borough surveyors in England.)

March 19, 1913

Some costs on construction of concrete pavement. By C. M. Boynton. (Pp. 311–312.

March 26, 1913

A classification of road building rocks. By Chas. P. Berkey. Pp. 341–342. (Petrographic classifications.)

April 2, 1913

Average unit prices of pavements constructed in 1912 in 568 cities. Pp. 373–381, 384–389. (Average amount—average price and some details of brick pavement in 1912 in 257 cities—concrete pavements in 1912 in 140 cities—stone block pavements in 1912 in 47 cities—bithulithic pavements in 1912 in 60 cities—wood block pavements in 1912 in 50 cities—mileage of pavement proposed for 1913.)

Instructions of the bureau of highways, Manhattan Borough, New York City, for the guidance of its inspectors of street paving. Pp. 379–384. (General instructions—preparation of subfoundation—curbing—concrete foundation for pavement—sheet asphalt pavements—granite block paving—asphalt block pavement—wood block pavement—instructions to district inspectors—instructions governing sidewalk repairs—instructions to inspectors of repairs on old pavements.)

April 9, 1913

Topeka Specifications, binder course. From Association for Standardizing Paving Specifications. Pp. 417–418.

April 16, 1913

An accounting system of the Maryland State roads commission. Pp. 449–451. (Classification of expenditures—entering rules for expenditures in primary accounts.)

Value of specifications and tests for bituminous materials. By C. S. Reeve. p. 452.

April 23, 1913

Organization of town highway departments. By Fred Bush. Pp. 454–455. (Organization in New York—town superintendent of highways—revenues for repair and maintenance—results obtained—defects matters of detail, not of fundamental plan.)

April 30, 1913

The rock asphalt pavements of Lawton, Oklahoma. By F. B. King. Pp. 485–487. (Oklahoma natural rock asphalt base—Oklahoma natural rock asphalt pavement, wearing surface.)

Road construction and maintenance in the Philippines. Pp. 487–488. (Statistics of work accomplished since United States occupation.)

Clay clinker road construction. By W. W. Andrews. Pp. 488–489. (Experimental work in province of Saskatchewan—method of construction.)

Economic theory of drawbridge design. By H. G. Tyrrell. Pp. 500–502. (Essentials—design—possible future improvement—provision for travel under bridges—provision for road travel—duplex bridges—number of decks—provision for widening—number of trusses—general outline—one or two leaves—tail anchors—skews—aesthetic treatment.)

Some features of highway bridge practice without engineering supervision. By F. R. White and J. H. Ames. Pp. 502–504. (Failure of certain bridges in Iowa owing to lack of engineering supervision.)

May 7, 1913

Highway maintenance costs in foreign countries. By A. W. Prescott and J. E. Pennybacker. Pp. 514–515. (Review of publication of Joint Committee on Federal Aid.)

Instructions for building State-aid roads in Wisconsin. By A. R. Hirst. Pp. 515–516. (Width of surface—laying out subgrade or trench—plow work—grader work—hand work—rolling subgrade—weights of material—spreading—daily output—first course—harrowing—second course—third course or screenings—flushing—trimming up).

Specifications of the Illinois highway commission for concrete road construction. By A. N. Johnson. Pp. 517–518.

A comparative study of limiting span, maximum span and economic span for suspension bridges and cantilever bridges. By D. B. Steinman. Pp. 518–523. (Suspension bridges—estimate of cost—empiric formulas for weights—maximum span—economic span—cantilever bridges—estimate of cost—empiric formulas for weights of cantilever spans—limiting spans—maximum practical span—largest cross-sections in actual use—economic span—span of equal cost.)

May 14, 1913

Cost and service comparisons of motor trucks and horse drawn vehicles. By Clinton Brettell. Pp. 538–542. (Motor trucking—fixed charges—variable or mileage charges—horse trucking—fixed charges—variable charges.)

Comparative statistics on cost of road construction (Staff article). Pp. 544–548. (Review of publication of Joint Committee on Federal Aid.)

May 21, 1913

Method and cost of asphaltic macadam construction on the boulevard system of Kansas City, Missouri. By C. W. Redpath. Pp. 566–568. (Cost of labor and materials in applying asphalt on macadam by penetration method.)

May 28, 1913

Bituminous macadam construction by the Illinois highway commission Pp. 594–595. (Apparatus—methods of construction.)

Highway construction with paint binder and its sheet asphalt surface. By A. E. Loder. Pp. 595–596. (Construction in California.)

Cost of concrete road construction by the Illinois highway commission. By A. N. Johnson. P. 596. (Review of work actually done.)

Conclusions and cost data on macadam construction in Illinois. Pp. 597–599. (Conclusions as to thickness and width—on waterbound macadam—on bituminous macadam—analysis of tars.)

Method of replacing a five-span through truss bridge with deck plate girder spans, Chicago and Alton Railway. (Staff article.) Pp. 606–608. (Construction over Kankakee River at Wilmington, Illinois.)

June 4, 1913

Should we "pay as we go" for roads and other public works. Pp. 621–622. (Arguments in favor of bond issues.)

Bituminous gravel concrete road surfaces. By S. J. Stewart. Pp. 625–626. (Specifications regarding gravel—causes for failure or success of bituminous—gravel roads.)

Bituminous resurfacing by the Illinois highway commission in 1912. Pp. 626–627. (Experimental work of the commisison—cost of work on various roads.)

Experimental road work of the public roads department of New Jersey. By R. B. Gage. Pp. 629–630. (Gravel base with bituminous surface—glutrin, westrumite—concrete on cobblestones and bituminous surface—repairing gravel roads.)

Traversing bridges. By H. G. Tyrrell. Pp. 640–643. (Classification (underbridges, overbridges, telescoping, traveling elevated, duplex)—advantages and disadvantages—floors—wheels for traversing bridges—weight—underbridges and overbridges—overbridges on hydraulic pistons—over rolling bridges with projecting counterpoise—bridges with movable rear roadway sections—telescoping bridges—elevated ferries on piers—duplex bridges—retractile bridges—comparative cost of various types.)

June 11, 1913

Repair and maintenance of macadam roads. By L. I. Hewes. Pp. 650–653. (Review of Office of Public Roads Bulletin 48.)

Maintenance of sheet asphalt pavements. By F. P. Smith. Pp. 653–656. (Traffic deterioration—effect of ageing and exposure—defects in construction—repairing.)

Instructions of the bureau of highways, Queens Borough, New York City, to inspectors of highway improvements. Pp. 656–658. (General instructions—grading—concrete—concrete curb—cement sidewalk—blue stone curb—flagstone sidewalk—sheet asphalt pavement—asphaltic concrete—asphalt block—wood block—granite block—brick pavement.)

June 18, 1913

Sand-clay road construction in Butler County, Alabama. By G. C. Scales. P. 679. (Method of construction.)

Road management. By L. I. Hewes. Pp. 679–683. (Review of Office of Public Roads Bulletin 48.)

Method of constructing an iron viaduct for 100 per cent increase in load. By W. T. Curtis. Pp. 688–690. (Construction over Manistee River, on Chicago and West Michigan Railway line.)

June 25, 1913

Instructions of the board of local improvements, Chicago, Illinois, to its sub-inspectors of paving work.) Pp. 708–709. (General—daily reports—curb and gutter, etc.—concrete foundation—asphalt paving—asphaltic concrete—creosoted wood block—granite and brick paving.)

Comparison of different types of wearing surfaces used for the roadways of bridges. By H. B. Browne. Pp. 43–46. (Plank, wood-block, sheet asphalt, stone block, brick, concrete.)

July 16, 1913

Reinforced concrete paving at Port Huron, Michigan. By E. R. Whitmore. Pp. 62–64. (Description of work—economy—cleanliness—acceptability.)

Observations noted since 1908 as to the various causes of wear and of deterioration of roadways. (Reports from 3rd International RoadCongress.) Pp. 64–67. (Roadways in town and suburban districts—roadways in suburban districts and open country; macadam, concrete, bituminous-macadam, brick.)

July 23, 1913

Supplementary reports on the 1907, 1908, 1909, 1910, and 1911 dust prevention and road preservation experimental work of the United States Office of Public Roads. Pp. 90–95. (Review of 1912 progress report on dust prevention and road preservation, Office of Public Roads.)

Surface treatment and bituminous macadam construction with high pressure spraying machines. By Thomas Aitken. Pp. 95–97. (Surface treatment—bituminous-macadam construction.)

July 30, 1913

Experimental work in dust prevention and road preservation in 1912 by the United States Office of Public Roads. Pp. 114–119. (Review of 1912 Office of Public Roads progress report.)

August 6, 1913

Comparative advantages of different types of roads. By J. R. Robbin. Pp. 150–151. (Effect of traffic—difference between main trunk lines and country roads—value of various binders—gravel surfaced roads—park roads—surface treatments.)

Notes on the tar treatment of road surfaces. Pp. 152–153. (Proper foundation necessary—application of tar, etc.—selection of binder.)

August 13, 1913

Design of a small bascule highway draw-span. By L. E. Moore. Pp. 179-181. (General conditions governing the design—description of bridge superstructure—operating mechanism and counterweight—description of pier—description of locking mechanism—cost data.)

August 20, 1913

Practice and experience with algarrobo wood pavements in Buenos Aires, Argentina. By C. C. Dassen. Pp. 198-199. (Method of construction—curbs—concrete foundation—statistics—life.)

Organization of the engineering forces of the State Roads Commission of Maryland. By W. W. Crosby. Pp. 199-201. (Aims of organization—State-aid in Maryland—personnel—salaries and duties—contractors.)

Third International Road Congress, London, 1913. By A. H. Blanchard. Pp. 201-202. (Work of the Congress—outline of discussions.)

August 27, 1913

Macadam construction with slag concrete binder. By A. Cornet. (Third International Road Congress.) Pp. 226-227. (Description of slag used—concrete binder—cost data and method of construction.)

English practice in wood paving. By A. Brown, E. E. Mawbey, W. N. Blair and O. E. Winter. (Third International Road Congress.) Pp. 227-229. (Choice of woods—preservative process—methods of paving in use—resistance to wear—methods of maintenance—cleansing and watering.)

September 3, 1913

The patch system of road maintenance. By Zdensko Vytvan. (Third International Road Congress.) Pp. 263-264. (Constant patching necessary—selection of materials and quantities—method of repairing.

Machine rammers for compacting broken stone. By C. Guillet. (Third International Road Congress.) Pp. 264-265. (Description of machine—method of application.)

Wood block pavements in Australia. By A. C. Mountain. (Third International Road Congress.) Pp. 265-266. (Classes of wood—durability of pavements.)

Utilisation of lead slag for pavement purposes. By D. C. Callais. (Third International Road Congress.) P. 266. (Cost data—methods of construction—experiments at Athens, Greece.)

Data for use in designing culverts and short span highway bridges. (Office of Public Roads Bulletin 45.) Pp. 274-278, 279. (Area of waterway—types of pipe culverts—vitrified clay pipe culverts—cast-iron pipe culverts—corrugated iron pipe—concrete culverts—reinforcement—box culverts—T-beam superstructures.)

Types of surfacing to be adopted on bridges and viaducts. (Third International Road Congress.) Pp. 278-280. (Resolutions adopted by the Congress.)

September 10, 1913

Planning of new streets and roads. By N. P. Lewis. Pp. 285-287. (Selection governed by traffic demands—need for radial roads—tramways—isles of safety in cities—considerations governing planning of individual roads or complete highway system.)

Authorities in charge of construction and maintenance of highway system of France. By E. Marion. (Third International Road Congress.) Pp. 289-290. (Technical staff—staff of the Ponts and Chaussées—staff of the Agents-voyers, surveyors—workman staff—organisation for construction, maintenance and repairs—national roads, department roads —urban and rural roads—system of inspection—national roads—department roads, roads of main communication and common interest.)

September 17, 1913

Data for use in designing culverts and short-span highway bridges. (From office of Public Roads Bulletin 45, continued.) Pp. 324-328. (Arch bridges and culverts—typical details (railings, end and wing walls, abutment walls)—specifications for reinforced concrete bridge and culvert construction.)

September 24, 1913

Summary of practice of various countries in construction of macadamised roads bound with bituminous, tarry or asphaltic materials. (Third International Road Congress.) Pp. 339-343. (Summary of reports dealing with this topic—foundations and drainage—sizes and shapes of broken stone for bituminous bound surface crust—use of partially worn materials in bituminous bound surface crust—thickness and composition of strength crust and of super or wearing crust under different conditions—life of surface crust under different conditions of traffic, weather, subsoil, etc.—relative importance of patching, repairs, and periodical renewals of surface crust—extent of wear permissible before renewal of surface coating—measurement of wear and appliances used for this purpose—methods of bituminous treatments—relative advantages and use of tar, tarry compounds, asphalt, bitumens, and other materials—tests and chemical analysis of tarry, bituminous and asphaltic compounds—climatic effects causing slipperiness of the roadway and remedies—effect on public health, fish life or vegetation—cleansing and watering.)

Work of Massachusetts highway commission in 1912. (From 1911-1912, Massachusetts Highway Commission report.) P. 343. (Statistics of year's work.)

October 1, 1913

Report on the use of concrete as a paving material. By P. E. Green. Pp. 367-370. (Description of experiments made—Highland Park, Michigan; Windsor, Ontario; Detroit, Michigan; Wayne County, Michigan—maintenance—labor—resurfacing with Dolarway.)

Some principles relative to the design of large bridges with special reference to the New Quebec bridge. By R. Modjeski. (*Journal of Franklin Institute.*) Pp. 380-389. (Location—length of spans—types of superstructure (Steel arches, simple spans, cantilever spans, suspension bridges)—secondary stresses—materials.)

October 8, 1913

Construction in France of macadamized roads bound with tarry, bituminous or asphaltic materials. By Wendor, LeGavrian, Mayer and Frontard. (Third International Road Congress.) Pp. 401-405. (Roads superficially tarred—grouted road surfaces—use of tar proper—examples of road construction in various parts of France.)

Methods of securing good maintenance of earth roads. By W. S. Keller (Third International Road Congress.) P. 425. (Patrol system of macadam roads inadequate for earth roads—drag needed to help—statute labor.)

Standard practice of Wisconsin Highway Commission for waterway structures. By A. R. Hirst. (American Road Congress.) Pp. 425–426. (State aid in bridge construction—divided into 5 classes according to length of span—bids for construction.)

October 22, 1913

The technical and administrative organisations of the French road system—By Jean de Pulligny. (American Society of Civil Engineers, *Proceedings*, vol. 39, p. 1716. Pp. 449, 453–455, editorial.) (Technical organisation—salaries (by departments.))

Traffic census of the Wayne County concrete roads. (Editorial.) P. 449.

Service records of concrete pavement with critical suggestions for obtaining improved service. By F. F. Rogers. (American Road Congress.) Pp. 450–453. (Statistics for various roads—defects in various roads.)

Some points relative to the design and shipment of plate girders. By C. H. Marrs (From *Applied Science*, August.) Pp. 459–461. (Girders on curves—loads and stresses—spacing of girders on curves—method of bracing girders for shipment.)

October 29, 1913

Economies of highway location; formulas and methods employed in locating roads. By E. Masik (Third International Road Congress.) Pp. 478–483. (General direction—alignment—grades—method of locating center line—longitudinal and cross sections—cross sections of Austrian roads—curves—calculation of the maximum speed of fast motor cars.)

Observations on European paving methods and materials. By E. H. Thomes. Pp. 483–485. (Pavement testing machine—pavement studies in Liverpool—stone block pavement—wood block pavements.)

November 12, 1913

Internal temperature range in concrete arch bridges. P. 533. (Editorial Review of Bulletin 30 Iowa State College—by C. S. Nichols and C. B. McCullough. Pp. 546–555. (Previous experiments—Squaw Creek arch, tests 1909–1910—electrical thermometer measurements on Squaw Creek arch, Boone Street, 1911–1912—experiments on the Walnut Street Bridge, Des Moines, Iowa, 1911–1912—correlation of various results.)

Principles governing design and operation of construction equipment for bituminous pavements. By F. P. Smith. (American Society of Civil Engineers, *Proceedings*, vol. 39, p. 1735.) Pp. 536–537. (Drying and heating the mineral aggregate—preparing and heating the cementing material—mixing the hot mineral aggregate with hot asphalt cement—rollers.)

New Rules and regulations governing traffic on New York highways. By J. N. Carlisle. Pp. 537–538.

November 19, 1913

Pavement construction with bricks, laid flatwise or with the fiber in a vertical position. By Jas. T. Tucker. Pp. 585–586. (Advantageous in strength, smoothness, noiselessness.)

November 26, 1913

Methods and cost of constructing a concrete road near Mason City, Iowa. (Staff article.) Pp. 605–606. (Method of construction—cost data.)

A comparison of fixed and 3-hinged concrete arches and advantages of concrete arches with two ribs over those with solid soffits. By W. M.

Smith, Sr. and W. M. Smith, Jr. (American Society of Civil Engineers, *Proceedings*, vol. 39, P. 1193.) Pp. 610–613. (Comparison of fixed and 3-hinged concrete arches—comparative costs of fixed and 3-hinged types—comparison of I-section and rectangular ribs—shape of piers.)

December 3, 1913

Trailers for use with contractors' motor trucks (Staff article.) Pp. 629–630. (Daily tonnage delivered—ton-mile costs.)

Methods of constructing sidehill roads and culverts in the mountains of Colorado. By C. H. Baldwin. Pp. 630–631. (Pueblo Convention of Road Builders.)

December 10, 1913

Importance of standard methods of keeping accurate and reliable cost records of highway construction and maintenance. By Maj. W. W. Crosby. (American Society of Civil Engineers, *Proceedings*, vol. 39, Pp. 1697–1702.) Pp. 666–668. (Subdivision of highway cost or expense into items of ordinary use—subdivision of total expense of Maryland State Roads Commission for years 1908, 1909, 1910, and 1911.)

Cost of construction and maintenance and traffic census of experimental pitch—macadam section of the Park Heights Avenue Road near Baltimore, Maryland. By Maj. W. W. Crosby. (American Society of Civil Engineers, *Proceedings*, vol. 39, pp. 1702–1711.) Pp. 668–670. (Construction and maintenance expenditures—net charges for construction and maintenance of pitch macadam.)

December 17, 1913

A discussion of road location and construction with special reference to drainage and protection from floods. By S. D. Foster. (American Road Builders' Association.) Pp. 697–698. (Drainage—provision for floods—slides—grades and alignment.)

Specifications for pavements constructed with bricks laid flatwise or with the fiber in a vertical position. Pp. 698–699. (Specifications of Western Paving Brick Manufacturers Association.)

December 24, 1913

Drainage and maintenance of earth roads. By E. A. Kingsley. (American Road Builders' Association.) P. 726. (Methods for obtaining drainage—system of maintenance.)

Testing of bituminous materials for road and street construction and importance of relation of such tests to paving specifications. By P. Hubbard. (American Road Builders Association.) Pp. 727–728. (Value of tests of chemical and physical properties—description of various tests.)

Winter courses in highway engineering at Columbia University and Iowa State College. (Staff article.) P. 728. (Outline of courses.)

December 31, 1913

Chemical and physical effects of water on macadam road construction. By W. G. Fearnsides (From *The Surveyor*, November 28.) Pp. 751–753. (Chemical effects—physical effects—tensile and crushing strength—potholes—"site-rocks"—variation in the properties of water—sub-crust dew—phenomena of frost).

Methods and costs of using bituminous surface treatments and dust preventives on roads and streets at Philadelphia. By Wm. H. Connell. (American Road Builders' Association.) Pp. 753–754. (Statistics of 1913 work of Philadelphia Bureau of Highways—analysis of tar treatments and other preparations.)

A comparison of the unit price, lump sum and percentage work forms of highway contract on the basis of costs and moral aspects. By A. C. Hill. (American Road Builders' Association.) Pp. 755–756. (Explanation of various systems and relative advantages.)

FROM "ENGINEERING MAGAZINE"

June 1913,

Concrete roads. By E. N. Hines. Pp. 415–417. (Experience and methods of construction in Wayne County, Michigan.)

July, 1913

Developing the ideal road. By R. E. Crompton. Pp. 586–588. (A study of elasticity and durability in modern surfaces.)

September, 1913

The motor truck in contracting and construction work. By R. W. Hutchinson, Jr. Pp. 793–816. (Illustrated) (Efficiency of motor trucks in various work, (municipal, subways, aqueducts and paving)—data regarding number of hauls, size of loads, cost of hauling, etc.)

October, 1913

Motor trucks in contracting and construction work. By R. W. Hutchinson, Jr. Pp. 77–94. (Illustrated) (Efficiency, etc. of trucks in road-making and paving.)

November, 1913

Motor trucks in contracting and construction work. By R. W. Hutchinson, Jr. Pp. 237–248. (Contractor's objections, both valid and invalid.)

Brick paving for country roads. By V. M. Peirce and C. H. Moorefield. Pp. 283–286. (Review of Department of Agriculture Bulletin 23, information relative to preparation, construction and cost.)

December, 1913

Motor trucks in metal-mining industries. By R. W. Hutchinson, Jr. Pp. 365–379. (Efficiency of trucks in mining industries.)

FROM "ENGINEERING NEWS"

January 9, 1913

County and township organization of highway work. By A. N. Johnson. (American Road Builders' Association, 1912.) Pp. 50–51. (Town road commissioner—working force—road machinery county and town coöperation—construction work on roads—construction of hard roads—construction work on culverts—construction of bridges—maintenance of earth roads—patrolling roads—franchises for rights of way.)

Protective coatings for railway bridge floors. By A. W. Carpenter. (Maintenance-of-Way Master Painters' Association, 1912.) Pp. 60–61. (Tar cement coating—cement-mortar coating—protecting other parts of bridge floors.)

Revelations concerning New York State highway work. (Editorial.) Pp. 80–82. (Criticism of long-term bond issues, inefficiency and wastefulness in highway affairs in New York State.)

January 16, 1913

Stone crushing and screening, Fairmount, Illinois. By K. E. Casparis. Pp. 112–116. (Development of plants for crushed stone—capacity of crushers in regard to size handled—extensive use of machinery and mechanical appliances.)

February 13, 1913

Modern road-making machinery and its use. By T. R. Agg. (Illinois Society of Engineers and Surveyors, 1913.) Pp. 310–311. (Plant for earth roads, macadam roads, bituminous—macadam roads, concrete roads.)

March 27, 1913

Building a paved roadway across a swamp. By James Owen. (County Engineers of New Jersey, 1913). Pp. 600–601) Method of construction of road from Newark to Jersey City, N. J.)

April 10, 1913

Philippine road maintenance problems. (From Annual Report Director of Public Works, 1911–1912). P. 701. (Heavy rainfall and consequent destruction of roads.)

April 17, 1913

Reports (of Legislature) on the organisation of Highway Department for the State of New York. Pp. 779–780. (Majority and minority reports.)

April 24, 1913

Pole-truss highway bridges on mountain roads in Washington. By C. R. Ege. Pp. 842–843. (Description of various bridges.)

May 1, 1913

A rational culvert formula. By W. W. Horner. Pp. 912–913. (Rainfall—derivation of formula.)

May 8, 1913

A method of proportioning concrete. By Wm. B. Hunter. Pp. 956–958. (Various methods discussed—use of diagrams—method of computation.)

May 15, 1913

Where should the money for good roads construction be spent. (Editorial.) P. 1012. (Automobile or pleasure roads not of first importance—local roads more important.)

May 22, 1913

The Bourne scheme for federal aid to road construction. (Editorial.) Pp. 1074–1075. (Points out certain fallacies in Ex-Senator Bourne's scheme.)

Value of a binder course in bituminous pavements. By F. N. Bingham. P. 1079.

May 29, 1913

Improving desert roads for motor-truck hauling. Pp. 1126–1127. (Plank roads—bush and straw roads—freight haulage.)

June 12, 1913

Best road surfaces for different kinds of traffic. By Wm. D. Sohier. (American Road Builders' Association, 1912.) Pp. 1206–1207. (Roads for motor vehicle traffic only—maintenance costs—bituminous binders and dust layers for old roads—effect of traffic on bituminous surfaces—where heavy oils fail—heavy horse-drawn wagons cause failure—hot oil blanket surface.)

July 24, 1913

A small bascule highway draw span. Pp. 166–168. (Method of construction.)

The Third International Road Congress at London. By E. L. Corthell. Pp. 182–184. (Discussion of work and outline of papers.)

The Third International Road Congress. By N. P. Lewis. Pp. 184–185. (Discussion of work of Congress.)

July 27, 1913

Plain concrete paving used in Kansas City, Missouri. By C. R. Mandigo. Pp. 112–115. (Early use of concrete for pavements in Kansas City—expansion joints—specifications—construction details—costs—advantages and disadvantages.)

Common sense concerning concrete road paving. (Editorial.) P. 125.

The new Iowa road law (1913). By A. Marston. Pp. 131–132. (Explanation of clauses of law.)

August 14, 1913

Instructions for foreman and contractors on State road construction in Wisconsin. (Bulletin 12, Wisconsin State Highway Commission.) Pp. 291–293. (Grading—preparing for surfacing—surfacing macadam—other surfaces.)

August 21, 1913

Economy in road location on sandy soils. By R. Watts. P. 345.

August 28, 1913

Some necessary precautions in the design and supervision of construction of low-truss steel highway bridges. By G. M. Braune. Pp. 398–399. (Precautions when using a heavy concrete floor—points about some details—supervision of construction—proposed legislation.)

September 25, 1913

Causes of wear and deterioration of roadways. By L. I. Hewes. (Third International Road Congress.) Pp. 587–588. (Macadam roads—concrete roads—bituminous-bound macadam roads—brick roads.)

An oak-keyed Belgian block pavement. Pp. 602–603. (Method of construction.)

Recent improvements in macadam road machinery. By A. W. Dean. (Third International Road Congress.) Pp. 603–604. (Driers—mixers—heaters—oil and tar distributors.)

Problem of economic road construction. (Editorial.) Pp. 619–622. Discussion of present-day difficulties of road engineering—question of maintenance important.)

Concrete road construction. By A. N. Johnson. (Third International Road Congress. Pp. 627–628. (Expansion or contraction joints—materials drainage—2-course construction—curing the concrete—crown—thickness—finish—conduct of construction—costs.)

Effect of heavy motor traffic on cost of road maintenance. By H. T. Wakelam. P. 630. (Increased cost of road maintenance due to heavy motor traffic.)

October 9, 1913

American Road Congress at Detroit. Pp. 726–727. (Discussion of work of Congress.)

Concrete roads of Wayne County, Michigan. By F. F. Rogers. (American Road Congress.) Pp. 730–732. (Description of work on various roads.)

October 23, 1913

Prospects of State highway administration in New York. (Editorial.) P. 829.

November 6, 1913

Partial failure of a light highway bridge. By F. Tessington. Pp. 904–905. (Case of bridge which failed to act structurally as designed, but still carries its load in a manner unforseen by its designers.)

A plea for earth roads. (Editorial.) P. 933.

November 13, 1913

Provincial public works organization of the Philippine Islands and its engineering personnel. By E. J. Westerhouse. Pp. 958–962. (Discusses construction of roads in Philippine Islands.)

New York State Road Organization. Pp. 982–984. (History of road movement in New York State—reorganization recommended—traffic census and statistics — specifications — determination of types — state and county highways—maintenance—town highways—inspection and supervision of town highways—bridges.)

The Pennsylvania vote on a $50,000,000 bond issue for good roads. (Editorial.) Pp. 986–987.

December 4, 1913

Heaving of wood-block pavement under extreme climatic conditions. By H. M. Roberts and P. E. Green. Pp. 1134–1137. (Report on wood block paving at Longview, Texas.)

Investigation of New York State Highway work. (Editorial.) P. 1142–1143.

The Warren patents on bitulithic paving. By Warren Bros. Co. Pp. 1145–1146. (Discussion of bitulithic type of pavement.)

Types of New York State roads. By W. G. Harger. Pp. 1148–1154. (Classification of State highways—cost data on different kinds of road surfacing—cost of standard types of pavement—brick on concrete foundation, asphalt concrete on concrete base, bituminous-macadam on various bases, concrete roads with thin protecting bituminous surface—practice in pavement design—grouted bituminous-macadam—waterbound macadam with refined tar surface coat—concrete roads—Kentucky rock asphalt—amiesite and rocmac—vitrified clay cube surfacing.)

December 11, 1913

Observations on bridge expansion. By H. A. Loser. Pp. 1170–1171. (Examples of expansion—improper placing of rollers in erection.)

New specifications for New York State highway work. P. 1203.

December 18, 1913

Annual convention of American Road Builders' Association. Pp. 1256–1257. (Highway organization—construction—maintenance.)

December 25, 1913

Railing with subsurface curb for shoulders of road embankments. By R. Watts. P. 1304.

FROM "ENGINEERING RECORD"

January 4, 1913

Year's work of the Office of Public Roads. P. 13. (Review of annual report 1911-12.)

Plant for road building. By F. E. Ellis. (American Road Builders' Association.) Pp. 27-28. (Interest and depreciation—wagons—stone crushers—engines and boilers—tractors and rollers.)

January 18, 1913

Latest bill for national aid in road improvement. P. 58. (Review of Senator Swanson's bill. Favorable criticism.)

Method of determining the toughness of bituminous materials. By J. E. Myers. (American Association for Advancement of Science.) P. 72. (Testing methods—test specifications.)

January 25, 1913

Mechanical horse and wagon for pavement tests. By J. C. McCabe. P. 105. (Description of machine installed in Department of Public Works, Detroit, Michigan.)

February 1, 1913

Methods of repairing cement-concrete pavements. By F. F. Rogers. (American Association for Advancement of Science.) P. 131. (Repair and maintenance of concrete roads of Wayne County, Michigan.

Influence of traffic on highway bridge design. By F. H. Neff. (American Association for Advancement of Science.) P. 132. (Weights of trucks in New York City—dynamic effects of modern traffic—clearance of bridges and approaches.)

Wood-block paving practice. (American Wood Preservers' Association.) Pp. 133-134. (Woods for paving bricks—By H. G. Davis; Wood block for pavements—By H. S. Loud; Suggestions for laying wood-block pavement—By H. L. Collier.)

Bituminous gravel concrete pavement. By S. J. Stewart. (American Association for Advancement of Science.) P. 135. (Method of construction—construction cost.)

Suitable foundations for brick pavements. By Robert Hoffmann. P. 138. (Cost of brick pavements—relative economy of sand and concrete foundations—advantages of concrete.)

February 15, 1913

Bascule highway bridge with overhead balance beams. P. 177. (Description of bridge at Phoenix, New York, over New York Barge Canal.)

Determining the consistency of bituminous materials. By Maj. W. W. Crosby. Pp. 192-193. (Measuring instruments—consistency at different temperatures—importance of residue determination—specifications.)

February 22, 1913

Bridge trusses with uniform T-shape members. P. 202. (Description of bridge over Ohio River in boroughs of Rochester and Monaca, Beaver County, Pennsylvania.)

A mile of test pavements on Second Avenue, New York. By H. W. Durham. P. 213. (Description of various pavements; wood block, Medina sandstone, sheet asphalt, asphalt block, hard wood, rock asphalt, granite block.)

Concrete highway bridge at Ansonia, Connecticut. Pp. 219–220. (Arches —spandral walls and sidewalk construction—east approach—methods of construction.)

March 1, 1913

New York Road commission. P. 225. (Criticism of past work.)

Cost data on street paving. By W. W. Kerch. Pp. 243–244. (Labor and material costs—pitch and grout filler—methods employed—overhead and bond charges.)

March 8, 1913

Riverbank, California experimental road. Pp. 258–259. Construction methods—expansion joints—materials used—tests.)

March 15, 1913

Necessity for traffic census on highways. By C. E. Foote. (Editorial. P. 281.) Pp. 300–301. (Growth of highway improvement—suggested census methods—appropriations required.)

Notes on concrete road construction in Wisconsin. By J. H. Kuelling. P. 292. (Methods of construction.)

April 5, 1913

Binder course in asphalt pavements. By F. N. Bingham. Pp. 391–392. (Specifications adopted by Association for Standardizing Paving Specifications.)

April 12, 1913

Maintenance and treatment of smooth pavements. By W. L. Hempelmann P. 414. (Methods of repair—creeping of pavement—waterproofing joints—treating asphalt and wood-block pavements—oiled sand.)

April 19, 1913

A comprehensive plan for state road improvement. P. 422. (Comparison of methods in New York and Illinois—system in Illinois.)

April 26, 1913

Characteristics and differentiation of native bitumens and their residuals. By Clifford Richardson. (Editorial. P. 453.) Pp. 466–468. (Fluxes (paraffine, semi-asphaltic, asphaltic, Mexican)—condensed or blown oils (California residual pitches, Trinidad residual pitches, Mexican residual pitches.)

Criticism of New York's new highway law. By E. W. Stern. P. 462. (Experience of railroad engineers desirable—salaries insufficient—selection of commissioner.)

May 3, 1913

Trucks and roads. (Editorial.) P. 481.

European creosote specifications for paving block for city streets. By E. A. Sterling. Pp. 495–496. Discussion of desirability of reducing amount of oil impregnation—European experience—results in Great Britain—practice in Paris and Switzerland—American conditions.)

May 10, 1913

Good roads and good sense. (Editorial.) P. 509. (Commendation of passage by Pennsylvania legislature of act to submit a $50,000,000 bond issue in 1915.)

May 17, 1913

Suspension bridges and cantilevers—Part 1. By D. B. Steinman. Pp. 547–548. (Suspension bridges—empiric formulae for weights—maximum span for suspension bridges.)

Traffic census on highways. By L. I. Hewes. Pp. 556–557. (Tonnage per acre—traffic variation—local considerations.)

May 24, 1913

Maintenance of roads. (Editorial.) P. 565. (Oiled macadam roads of southern California.)

Comparative economy of cantilever and suspension bridges. (Editorial.) Pp. 566–567. (Favorable criticism of article by D. B. Steinman in issue of May 17, 1913.)

Oiled macadam for residence streets in San Bernadino. P. 576. (Method of construction.)

Suspension bridges and cantilevers—Part II. By D. B. Steinman. Pp. 577–578. (Cantilever cost data-empiric formulae for weights— limiting spans for cantilevers—maximum practicable span—economic span for cantilevers—span of equal cost.)

May 31, 1913

Concrete bridge for a rural community. P. 605. (Example of bridge at Cumberland, Illinois—floor system—method of construction.)

June 7, 1913

Work of the Philadelphia bureau of highways. Pp. 627–628. (Portions of annual report dealing with reorganisation of staff and progress—maintenance of pavements—redressed granite block—macadam roads—service test roadway.)

June 14, 1913

The humble split log drag. (Editorial.) P. 649. (Value of drag for road improvement.)

June 28, 1913

Good road administration. (Editorial.) P. 705. (Iowa highway law.)

Inefficiency of highway construction. By F. R. White and J. H. Ames. P. 715–716. (Road construction in Iowa previous to 1913—extent of improved roads—poor administration of past.)

Chevy Chase experimental concrete road. Pp. 719–720. (Bituminous-oil-cement and plain cement-concrete highway pavement laid near Washington, D. C., by United States Office of Public Roads—features of design—oil-cement concrete—effect of cracks—expansion measurements.)

July 12, 1913

New Iowa road law. (Editorial.) P. 31. (Commendatory except criticism of failure of law to give highway commission supervision over maintenance.)

July 19, 1913

International Road Congress. (Editorial.) P. 57

Expansion and contraction measurements of concrete roadways. By A. T. Goldbeck. P. 76. (Measurements on Chevy Chase, Maryland experimental road.)

Constituent principles of highway maintenance. By L. I. Hewes. Pp. 77–78. (Analytical discussion of the economics of highway administration—training and preparation of highway officials—value of traffic census—road patrols—European practice in maintenance of roads—long-term bond issues.)

Piecework system in Philippine Road Construction. (From *Quarterly Bulletin*, Bureau of Public Works, Philippine Islands) Pp. 82–83. (Difficulties of task labor.)

July 26, 1913

Tests of road-building rocks. By L. W. Page. (American Society for Testing Materials.) Pp. 101–102. (Hardness vs. toughness test—abrasion vs. impact test—abrasion vs. hardness test.)

Illinois road law. P. 106. (Discussion of provisions 1913 law.)

August 2, 1913

Educational work in highway engineering. (Editorial.) P. 114. (Student course in United States Office of Public Roads.)

·Hammer drills in highway construction. P. 137. (Construction work on New York roads.)

August 9, 1913

Getting action on good roads. (Editorial.) P. 141. (Roads in Winona County, Minnesota.)

Winona County concrete roads. Pp. 159–169. (Planning the Winona road—farmers contribute—adopt concrete roads—future plans.)

Experiments in moving loads on highway bridge. By F. O. Dufour. Pp. 165–166. (Concentrated load—stress and distribution of floor load.)

August 16, 1913

Grasping road propaganda. (Editorial.) Pp. 169–170. (Activities of National Highway Association of South Yarmouth, Massachusetts.

Public works in the Philippine Islands under the American régime—Part I. By H. F. Cameron. Pp. 172–175. Includes articles on progress in road and bridge construction—good roads law—roads under Spanish régime—present types of roads—bridges—collapsible wooden bridge—maintenance of roads and bridges.)

Some observations on paving and bridge matters in England. By C. O. Burge. P. 196. (Exhibits of England at International Road Congress.)

August 23, 1913

Rock asphalt paving in San Antonio, Texas. P. 214.

August 30, 1913

Good-roads days. (Editorial.) Pp. 225–226. (Good-roads in Missouri discussed.)

Highway bridge specifications. (Review of publication of U. S. Office of Public Roads.) Pp. 230–232. (Loads—proportions and unit stresses—floor system—details of design and construction—materials.)

September, 6 1913

Federal aid for highway. (Editorial.) P. 254. (Adverse to hasty action.)

The coming road congress. (Editorial.) P. 254. (Refers to 3rd American Road Congress.)

Steel highway bridge specifications of the Office of Public Roads. (Editorial.) P. 255. (Discussion of article in issue of August 30, 1913.)

September 13, 1913

Surface-oiled roads in the Philippines, (*Quarterly Bulletin*, Bureau of Public Works, Philippine Islands.) P. 303.

Concrete specifications for bridge substructure. (Review of Office of Public Roads bulletin.) Pp. 305–306. (Materials—mixing—forms—joints—finish—reinforcement—abutments, wing walls, etc.)

September 20, 1913

Indictments for bad roads. Editorial). P. 311. (Condition of roads in Schuylkill County, Pennsylvannia.)

Design of large bridges, with special reference to Quebec Bridge—Part I. By R. Modjeski—(Franklin Institute.) Pp. 321–324. (Length of spans—substructure—types of span—maximum span lengths—new Quebec Bridge—erection by floating.)

September 27, 1913

Concrete roads for Wayne County, Michigan. (Editorial. P. 338.) Pp. 340–342 (Michigan road laws—building the roads—equipment—materials—maintenance and condition—organization.)

Permanent and impermanent elements of roads. (Editorial.) Pp. 338–339.

Asphalt paving cements and road binders. By J. W. Howard. Pp. 345–347. (Brand name and geographical source—irrelevant clauses in specifications—qualities which asphalt paving cements and road binders must possess—adhesiveness—effect of water—immutability and cohesiveness—ductility and flexibility—consistency and effect of temperature—impurities and injury by heat—numerical requirements.)

Experiments in brick road construction. By Jas. T. Voshell. Pp. 347–348. (Test data and costs of section containing 14 varieties of paving block concrete base—laying and grouting brick—expansion joints.)

Design of large bridges, with special reference to Quebec Bridge—Part II (continued). By Ralph Modejeski. Pp. 354– (Effect of labor conditions—system of trussing—selection of design—uniform deflections—features of Quebec design—determination of dead load.)

New York State highway department bridges. Pp. 361–362. (Standard types and details of steel girder and truss spans for suburban traffic—truss spans.)

October 4, 1913

Some features of concrete bridge design. (Editorial) P. 366.

Choosing highway superintendents under new Illinois law. By W. R. Robinson. P. 376. (Scope of examinations.)

Design of large bridges, with special reference to Quebec Bridge—Part III (continued.) By Ralph Modjeski. Pp. 383–385. (Bottom chords—top chords—suspension bridges—moving load—span limits—materials.)

Highways of New York State. By Geo. A. Ricker. Pp. 388–389. (Legal, financial and engineering considerations in expending $100,000,000 for roads—apportionment of funds—value of maintenance—types of pavement—unreasonable use of roads.)

Typical California concrete road near Roseville. P. 389. (Description of road—sources of materials.)

October 11, 1913

Road congress a success. (American Road Congress. (Editorial.) P. 393.
Road congress resolutions. (American Road Congress.) (Editorial.) Pp. 393–394. P. 401—statement of resolutions.)
Asphalt paving cements. By W. W. Crosby. Pp. 417–418.

October 18. 1913

What highway systems cost. (Editorial.) P. 421.
Road-roller test 4-inch concrete highway slab P. 432. (Character of test—loads.)
Brick pavements in Baltimore. By R. K. Compton. P. 436. (Present principles of laying brick pavements—laying of good brick—application of cement filler.)
Pointed observations on brick pavements and on the rattler test. By M. Schuyler. Pp. 447–448. (Doubtfulness of specifications—value of brick in paving—rattler test as time saver and effective test.)

October 25, 1913

Brick pavement cushions. (Editorial.) P. 449.
Accelerated pavement tests. (Editorial). P. 450. (Tests of brick pavements at American Road Congress.) P. 457–458. (Details of types tested with the "Determinator" at the American Road Congress at Detroit and a statement of the obvious results—foundation—brick pavement.)
Concrete roads. By A. N. Johnson. (American Road Congress.) P. 471. (Cracks—probable causes of cracking)
Rules governing the use of heavy vehicles on highways. Pp. 471–472. (Rules of New York highway commission.)

November 1, 1913

Rules governing the use of heavy vehicles on highways. P. 494. (Rules of Allegheny County, Pennsylvania—abstract of rules—test case—reasonable use of roads.)

November 8, 1913

Asphalt paving cements and road binders. By H. B. Pullar. P. 534. (Criticism of tests in use.)

November 15, 1913

Motor trucks and bridges. (Editorial. P. 535.
An unsatisfactory report. (Editorial.) P. 536. (Adverse criticism of 7th annual report (1912–1913) of Wayne County road commissioners.)
Report on highway reorganisation in New York State. Pp. 543–544. Plan of reorganisation—annual cost—state and county highways—method of division—inspection and supervision of town highways.)
Compensation for street-railway use of highway bridge. Pp. 557–558. (Compensation, past and present—investigation of trolley service—extra first-cost changes—depreciation and maintenance charges.)
Observations on brick pavement. By W. P. Blair. Pp. 561–562.

November 29, 1913

National-aid for highway bill. P. 596. (Review of H. R. bill 9838 introduced by Hon. D. W. Shackleford.)

December 6, 1913

Small-cube pavements of Monroe County, New York. By W. G. Harger. Pp. 624–626. (Service tests and costs of 2 inch blocks of gravel concrete, clay ash, of vitrified shale laid since 1908 near Rochester, New York—first gravel concrete cubes—concrete cubes on Newport House Road.)

Highway improvements in North Alabama. By P. S. Fitzgerald. Pp. 626–627. (Methods and costs of work, organization of field forces, and studies of plant for hauling and storing crushed stone—State aid—hauling with tractor—organization of field force—loading into wagons.)

Sand-clay road maintenance in North and South Carolina. By L. Tufts (American Road Congress) P. 627.

Experimental pavement in Philadelphia. Pp. 628–629. (Test section 3.4 miles long, composed of short stretches of different types of surfacing—description of foundation course for bituminous pavements.)

Dynamometer wagon for road resistance tests. Pp. 631–632. (Experiments of U. S. Office of Public Roads—measuring traffic effort on post roads and pull required for moving street cleaning apparatus.)

Cost of concrete base for pavements in Los Angeles. By C. S. Pope. Pp. 637–638.

Traffic and wear of English highways. P. 638. (Cost of maintenance—effect of motor vehicles—methods of surface treatment—reasons for road failure.)

Weight and cost of bridges. Pp. 640–641. (Comparison of different types of short-span overhead, grade-crossing bridges in Buffalo, having asphalt, wood and stone flooring.)

Highway construction in the Philippines. Pp. 641–642. (Experiences with native labor and use of coral as road building material—interprovincial routes—grades—surfacing materials.)

December 13, 1913

Progress on Pennsylvania's State highways. Pp. 652–653. (Work accomplished by Department organized under Sproul act of 1911 and notes on organization, construction and maintenance—growth of motor traffic receipts—experimental surfaces.)

Concrete road in Cook County, Ill. Pp. 653–654. Method of construction—striking off surface.)

Sub-organization for maintenance. By J. N. Carlisle. (American Road Builders' Association.) P. 672. (Work in New York State.)

Realignment, grading and drainage. By S. D. Foster. (American Road Builders' Association.) P. 672. (Drainage—road subjected to floods.)

Program for administering federal aid. By S. P. Hooper. (American Road Builders' Association.) Pp. 672–673. (Criticisms of plans offered program of plan suggested by author—designation of maintenance funds.)

Problems of administration. By Col. E. A. Stevens. (American Road Builders' Association.) Pp. 673–674. (Trained engineers essential—organization—methods of administering funds.)

December 20, 1913

Consolidation of the highway conventions. (Editorial.) P. 680.

Hard and soft fillers. (Editorial.) Pp. 680–681.

Work of the United States Office of Public Roads. Pp. 689–690. (Review of annual report.)

Unit price, lump sum and percentage work. By H. C. Hill. (American Road Builders' Association.) P. 700. (Advantages of unit prices.)

Engineer, inspector and contractor. By F. L. Cranford. (American Road Builders' Association.) P. 700. (Abstract.) (Objectionable contract clauses.)

Testing road materials. By P. Hubbard. (American Road Builders' Association.) Pp. 700–701. (Identification tests, uniformity in manufacture—discriminative tests—allowable variations.)

Convict labor in road construction. By J. H. Pratt. (American Road Builders' Association.) Pp. 701–702. (Plan of organization.)

American and British road tars. By Maj. W. W. Crosby. P. 703. (Comparative analyses to determine composition of several different products.)

December 27, 1913

Contractor, Engineer and Inspector. By F. L. Cranford. (American Road Builders' Association.) P. 724. (Measuring the engineer—the "fussy" engineer—the inspector—interpreting specifications.)

FROM "GOOD ROADS"

January 4, 1913

Convention of the American Road Builders' Association. (Editorial.) Pp. 1–3.

Traffic changes. (Editorial.) P. 3. (Changes in kind of vehicles.)

Third American Good Roads Congress and Ninth Annual Convention of the American Road Builders' Association. Pp. 4–59. (Discussions and various papers.)

Bituminous pavements for city streets. By George W. Tillson. (American Road Builders' Association.) Pp. 7–12. (History of bituminous pavement in United States—asphalts—construction of pavement—wearing surface—maintenance and repair—life of an asphalt pavement—asphalt block pavements—bitulithic pavement.)

Creosoted wood block pavement in the city of Minneapolis, Minnesota, as laid by the city by day labor. By E. R. Dutton. (American Road Builders' Association.) Pp. 13–16. (Description of work.)

Development of a plan for a State road system. By Jas. R. Marker. (American Road Builders' Association.) Pp. 18–21. (Growth of idea—Ohio highway law—work of Ohio Highway Department.)

Contractor's point of view. By H. Murphy. (American Road Builders' Association.) Pp. 22–25. (Discussion of clauses of contracts.)

Highway bridges and culverts. By W. A. McLean. (American Road Builders Association.) Pp. 30–35. (General types of bridges—architectural treatment of concrete—life of bridges—traffic and loading—shop inspection of steel—field inspection of steel bridges—bridge flooring—painting steel bridges—circular culverts—concrete construction—provision for cost—purchase of bridges—State influence.)

Economics of highway construction. By Clifford Richardson. Pp. 37–39. (American Road Builders' Association.) (Financing of roads—taxing of automobiles for road maintenance—New York State bond issues for roads.)

Traffic census as a preliminary to road improvement. Col. Wm. D. Sohier. (American Road Builders' Association.) Pp. 40–47. (Traffic and roads—traffic census on roads in Massachusetts in 1909 and 1912—sample traffic census observer's cars—method of tabulating—increases and changes in traffic from 1909 to 1912—pleasure traffic around Boston—increase in travel caused by building a good road—attractive scenery made accessible—country developed—values increased—Jacob's Ladder (Connecticut)—weight of traffic an important consideration—increase in motor traffic—width of roadway a vital consideration—kind of traffic—maintenance.)

Convict labor on road work. (American Road Builders' Association.) Pp. 50–54. (Conditions in Washington.)

Division of expense of road improvement over town or similar local unit, county, State and nation. (American Road Builders' Association.) Pp. 54–58. (Contains discussion of $500,000 federal appropriation for road building.)

Meeting of the American Road Builders' Association. P. 59. (Review of the meeting.)

February 1, 1913

Highway Department organization. (Editorial.) Pp. 77–78.

Maintaining earth roads. (Editorial.) P. 78.

Patented processes and materials. (Editorial.) Pp. 78–79.

Reliability of cost records. (Editorial.) P. 79.

Highway work under State-aid in Vermont. Pp. 80–83. (Review of latest biennial report of Department—source of road funds—location of roads—administrative organization—methods of construction.)

Third American Good Roads Congress and Ninth Annual Convention of American Road Builders' Association (continued). Pp. 84. (Discussions of various papers—highway organization.)

Organization of highway department for a large city. By Wm. H. Connell. (American Road Builders' Association.) Pp. 86–89. (Division of work—centralization of control—testing laboratory.)

County and township organization of highway work. By A. N. Johnson. (American Road Builders' Association.) 89–92. (Amount of work—funds available—highway organization—town road commissioner—road taxes—franchises for rights of way—equipment—patrolling the roads—construction work on roads and culverts—bridge work—maintenance work on earth roads—maintenance of hard roads—maintenance work on bridges—responsibility of town commissioner—contracts—general order of work—machinery—simple organization needed—county coöperation.)

Some features of macadam construction. By T. R. Agg. (American Road Builders' Association.) Pp. 101–103. (Water-bound construction—selection of materials—traffic to be considered—work of Illinois State Highway Department—durability of surfaces—development of bituminous-macadam roads—method of construction—screenings—binders.)

Earth and gravel roads. By Robert C. Terrell. (American Road Builders' Association.) Pp. 106–109. (Method of construction—drainage—location—crown—selection of gravel—maintenance.)

Laying of 102 miles of smooth road surface in one borough in 5 months. By G. H. Leavitt. (American Road Builders' Association.) Pp. 110–113. (Geographical layout—problem in 1912—character of the repaving—preparing the foundation—field organization—contractors' plants—progress of the work.)

Correction of alignment and grade in existing highway. By J. Y. McClintock. (American Road Builders' Association.) Pp. 113–114. (Discussion of grades—elimination of steep grades.)

Dust prevention. By Jas. H. MacDonald and others (American Road Builders' Association.) Pp. 116–118. (Discussion of experiences of various highway officials.

American Society of Civil Engineers. Special meetings on road construction. Pp. 120–123. (Discussion of various topics.)

March 1, 1913

Dust laying. (Editorial.) Pp. 141–142.

Types of roads. (Editorial.) Pp. 142–143.

Brick paved highways in northern New York. By Wm. C. Perkins. (American Association for the Advancement of Science.) Pp. 144–147. (History of brick roads in United States—wire-cut lug brick—method of construction of brick roads.)

Senate bill providing for direct National aid. P. 151. (Senator W. P. Jackson's bill—discussion of provisions.)

Roads in Philippine Islands. By W. A. Crossland. (Alabama Good Roads Convention.) Pp. 152–154. (System of construction and maintenance under Spanish regime—forced labor law—hauling in stiff wheeled carts—reorganisation of highway work, January 1, 1906—road conditions at present—maintenance system.)

Test pavements on Second Avenue in the Borough of Manhattan, New York City. By H. W. Durham. Pp. 156–157. (Detailed description of various pavements.)

Oklahoma rock asphalts and their use in paving. By L. C. Snider. Pp. 158–160. (Location of deposits—analyses of asphalt pavement samples—costs of sheet asphalt pavements in Oklahoma.)

Concrete road building in Wayne County, Michigan. (Profusely illustrated.) Pp. 161–164. (Review of 6th annual report of board of county road commissioners—method of construction.)

Bituminous concrete paving in Annapolis, Md. By J. B. Logan. Pp. 165–166. (Methods of construction—description of pavements laid.)

April 5, 1913

Federal participation in road building. (Editorial. Pp. 190–191. (Rather favorable toward federal aid.)

Year's progress in road building. (Editorial.) P. 191.

Taking care of the secondary roads. (Editorial.) P. 191.

Organisation of town highway departments. By Fred Buck. (American Association for the Advancement of Science.) Pp. 192–194. (Work in New York State—present highway law in New York State.)

Practical interpretation of stone tests. By H. S. Mattimore. P. 195. (Methods of testing materials.)

Limitations in the use of bituminous carpet surfaces. By A. W. Dean. (American Association for the Advancement of Science.) Pp. 196–197. (Limited by character of road crust, by character of carpet itself, and by character of traffic.)

Report of the New York Highway Advisory Committee. Pp. 233–234. (Recommendation for reorganisation of highway work in New York State.)

May 3, 1913

Contractors' equipment. (Editorial.) Pp. 255–256.

Road building terminology. (Editorial.) P. 256. (Refers to article on Pp. 264–267.)

Building roads for the traffic they are to carry. (Editorial.) Pp. 256–257

Cost accounting in highway work. (Editorial.) P. 257.

United States Government and the Third International Road Congress (Editorial.) P. 257.

Paving work in Hamilton County, Tennessee. Pp. 258–263. (Description of work done.)

Definitions proposed for terms used in highway work. By Maj. W. W. Crosby. Pp. 264–267.

New highway law in Iowa. P. 267. (Discussion of provisions.)
Granite block pavements in Augusta, Georgia. P. 268. (Description of blocks and methods of construction.)
Use of motor trucks in road work. Pp. 269–273. (Various uses to which trucks can be put.)
Concrete culverts in Grundy County, Missouri. Pp. 274–275. (Method of construction.)
Arterial roads for London, England. Pp. 275–. (Congested condition of roads and need for new construction.)
Investigation of road and bridge funds in Ashtabula County, Ohio. P. 276. (Methods of cost accounting in highway work.)

June 7, 1913

American Road Builders at the Third International Road Congress. (Editorial.) Pp. 309–310.
Convict labor. (Editorial.) P. 310. (Favorable criticism.)
Road administration in England. Pp. 317–319. (Organization—counties and boroughs—main roads—road expenditures—progress in road maintenance—review of work of Road Board.)
Progress of State highway work in California. Pp. 322–323. (Review of California Highway Bulletin—expenditures and mileage—plans of highway commission.))
British Road work. Pp. 326–328. (Traffic—methods of construction—selection of materials—wood and granite block—bituminous materials.)
Report on experimental pavements on the London-Folkestone Road, Kent, England. Pp. 329–330. (Reports on various sections as described in report of Road Board.)
The British Road Board. Pp. 334–335. (Articles concerning the various members.)
The "Sticky" test for bitumens. By C. B. Osborne. Pp. 337–338. (Description of test.)
Petrographic study of road building rocks in United States. Office of Public Roads. By E. C. E. Lord. (American Association for Advancement of Science.) P. 340. (General classification of rocks for road making—mineral constituents of rock used for road making.)

July 5, 1913

Reorganization of the Philadelphia bureau of highways and street cleaning. (Editorial.) Pp. 1–2.
Road and street planning. (Editorial P. 2.) Pp. 17–21. By Nelson P. Lewis (Third International Road Congress.)
(Early planning—influences of motor vehicles—State roads of New York—road system of Montgomery County, Ohio—road system of Philadelphia and vicinity—trunk line highways—road taxation—traffic—highways of New England towns—system of radial roads—speed of vehicles—scenic effects.)
Recent highway legislation. (Editorial.) Pp. 2–3. Pp. 8–14. (Legislation in Arkansas, Maine, Minnesota, and Missouri.)
Work of the Philadelphia bureau of highways and street cleaning. (From Annual Report, 1912.) Pp. 4–7. (Reorganization—kind and area of pavements in Philadelphia—operations of Bureau during 1912.)
The Simplon Road from Switzerland to Italy. By F. P. McKibben. Pp. 15–16. (Description of road.)
Toughness test of bituminous materials. By J. E. Myers. (American Association for Advancement of Science.) P. 16.

August 2, 1913

The London Road Congress. (Editorial.) Pp. 41–42. (Discussion of work and criticisms.)

Aesthetic design. (Editorial.) P. 42. (Application to highway and bridge engineering.)

The Third International Road Congress. Pp. 43–58. (Proceedings—resolutions—review of various questions—exhibition.)

New highway law in Illinois. P. 58. (Discussion of provisions.)

Wood pavements in the United States. By Geo. W. Tillson. Pp. 59–64. (History—kind of wood—size of blocks—character of preservative and amount to be used—quantity of oil—cushion coat on which blocks are to be laid—joint filling—expansion joint—specifications—repairs—cleaning.)

Brick paved roads in Cuyahoga County, Ohio. Pp. 64–65. (Description of roads.)

Use of bitulithic pavement in New York State road work. P. 67.

September 6, 1913

The ideal road. (Editorial.) Pp. 91–92. (What is the best road.)

Use of bituminous binders. (Editorial.) P. 92.

Reconstruction of the ancient fosseway in Nottinghamshire, England Pp. 94–96. (Reconstruction of old Roman roads.)

Standardizing road building terminology. P. 96. (Resolution of International Road Congress.)

Organization of the French engineers of bridges and highways. Inténieurs des Ponts et Chaussées. By Jean de Pulligny. Pp. 97–98.

Construction of bitumen bound broken stone roads. By J. Walker Smith (Third International Road Congress). Pp. 99–110. (Methods obtaining in various countries—quality of materials in road metal—intensity of traffic—tonnage—climate—foundations and drainage—sizes and shapes of broken stone for bituminous surface crust—use of partially worn materials in bituminous bound surface crust—thickness and composition of the strength crust and super or wearing crust under different conditions—life of surface crust under different conditions of traffic, weather, subsoil, etc.—relative importance of patching, repairs, and periodic renewals of surface crust—extent of wear permissible before renewal of surface coating—measurement of wear and appliances used for this purpose—various methods of bituminous treatment—relative advantages and use of tar, tarry compounds, asphalt, bitumen and other materials—tests and chemical analysis of tarry, bituminous, and asphaltic compounds—climatic effects causing slipperiness of the roadway; remedies—effect on public health, fish life, or vegetation—specification of the methods of construction—cost data—cleansing and watering—general and particular conclusions.)

Economic results of surface tarring. By E. Guglielminetti. (Third International Road Congress.) Pp. 11–112. (Results in France.)

New highway laws in Arizona. P. 112.

Third Annual report of the British Road Board. P. 113. (Yearly income of the Board—statement of amounts available at June 30, 1913, for grants and loans from the road improvement fund.)

Improvement of the Old National Road in Maryland. Pp. 114–115. (History of National Road—reconstruction.)

Report on the London—Folkestone Experimental Road. By Maj. W. W. Crosby. Pp. 117—118. (Discussion of various (23) sections.)

Road testing machine in the British National Physical Laboratory. P. 118.

New highway law in South Dakota. P. 119.

Opportunities for highway engineers in municipal work. Geo. W. Tillson (Society for the Promotion of Engineering Education.) Pp. 121–122. (Pavement construction—granite block objectionable—wood pavements—studies of new pavements—selection of materials—unit of traffic.)

October 4, 1913

Financing the building of roads. (Editorial.) Pp. 143–144.
National aid for building roads. (Editorial.) Pp. 144–145. (Growth of idea—advantages and disadvantages.)
American Road Builders' Convention. (Editorial.) P. 145.
Michigan Highway system. Pp. 146–150. (Progress up to present time—system of State rewards—classification of roads—appropriations—trunk line highway act.)
Experimental work on Park Heights Avenue in Baltimore County, Maryland. Pp. 154–156. (Description and construction costs of various sections—net charges for construction and maintenance of pitch macadam on Park Heights Avenue.)
Undergraduate course in chemistry for highway engineering students. P. 156. (Columbia University work with Prevost Hubbard.)
State highway work in Massachusetts. Pp. 157–159. (Review of 1912 report.)
Finance of road construction and maintenance. By G. M. Harris. (Third International Road Congress. Pp. 160–164. (Financial responsibility for roads—sources of revenue—loans—conclusions.)
Opportunities for highway engineers in the southern states. By Robert J. Potts. P. 164. Financial problems in highway engineering. By Geo. R. Chatburn. (Society for the Promotion of Engineering Education.) Pp. 167–168.
Alabama State highway work. Pp. 170–171. (Review of report for 1912–1913.)
The meaning of "macadam." By Maj. W. W. Crosby. P. 172.

November 1, 1913

Good roads days. (Editorial.) Pp. 195–196.
Organisation for highway work. (Editorial.) P. 196.
Road work in the new cemetery at North Arlington, N. J. Pp. 197–200. (Type of construction—drainage—method and description of construction.)
The Detroit Road Congress. Pp. 201–210. (Proceedings—exhibition.)
Twentieth annual Convention of the American Society of Municipal Improvements. Pp. 211–214. (Proceedings.)
The "Good Roads Day" in Missouri. Pp. 215–216.
Consolidation of embankments in road construction. By Geo. C. Warren. (20th Annual Convention of American Society of Municipal Improvements.) Pp. 223–224. (Proper methods of construction.)
The question of federal aid. By Maj. W. W. Crosby. Pp. 225–226. (Progress of the movement for federal aid—resolutions of American Road Builders' Association—need for further study before passage of bill.)

December 6, 1913

Business methods in highway work. (Editorial.) Pp. 353–354.
Highway engineers and the public. (Editorial.) P. 354.
Philadelphia's highway system. Pp. 355–362. (Extent—methods of construction—statistics—organisation.)
Highway engineering courses at Columbia University. P. 362.

Pennsylvania highway work. Pp. 363-369. (History—legislation—expenditures—organization of highway department—Sproul law.)

Traffic on Wayne County roads. P. 373. (Tables showing results of traffic counts on concrete roads in Wayne County, Mich.)

Report on New York State Highway Department. Pp.375-378. (Report of reorganization committee.)

Motor travel in Alaska. Pp. 378-379. (Experience of U. S. Army engineers.)

National or federal aid. By Maj. W. W. Crosby. Pp. 380-382. (Methods of application—suggested law.)

American Road Builders' Association. Pp. 389-391. (Proceedings—membership.)

FROM MUNICIPAL ENGINEERING

January, 1913

Grade and surface required on roads. Pp. 24-27. (Draft of vehicles—dynamometer wagon—grades—materials.)]

Prevention of defects in brick pavements. By Jas. E. Howard. Pp. 96-101. (Transverse cracks—lengthening of pavements—widening of cracks—contraction joints—temperature to lay a pavement—perfect pavement—effect of curves in street—longitudinal cracks—expansion joints—street railway tracks.)

Brick on country roads. By Wm. C. Perkins. (American Society for the Advancement of Science.) Pp. 106-113. (Brick roads in New York—advantages of wire-cut block to engineer—advantages to contractor—standard New York State design—construction details—laying brick—applying filler—expansion joints—tests of brick—cost of pavements.)

Road construction in Wayne County, Michigan. Pp. 131-134. (Concrete roads—main roads to be built—fund for road improvement—story of a country road—machinery used.)

March, 1913

Design of road as affected by traffic. By A. H. Blanchard. Pp. 190-191. (Effects of traffic on roads—information necessary.)

April, 1913

Road construction in Michigan. By F. F. Rogers. Pp. 305-310. (Cost of grading—drainage—macadam bed and shoulders—suitable stone for macadam—crushing cobbles—first course of macadam—top course of macadam—cost of macadam roads.)

How to repair asphalt pavements. By W. L. Hempelmann. Pp. 339-341. (Surface heater—joints to be waterproofed—waterproofing surface.)

July, 1913

Concrete pavement construction. By Morse-Warren Engineering Co. Pp. 8-18. (Pavement section—proportions—preparing foundations—quality of materials—screening—expansion and separation joints—proper mixing—placing the material—finishing the wearing surface—surface protection—curing the concrete—inspection—workmanship—conclusions.)

The brick road the cheapest and most economical. By S. C. Andrews. Pp. 60-62. (Comparison of costs of macadam, concrete and brick roads.)

August, 1913

European road building. By C. A. Kenyon. Pp. 106–109. (Attitude of English taxpayers towards road improvements—universal interest in roads—diversity of practice among engineers—value of foreign practice to Americans.)

Methods which have developed successful concrete pavements. Pp. 152–157. (Reasons for development of concrete roads about Detroit, Mich. steel reinforcement a great factor in the success—necessity for expansion joints—3 joint protectors—paving "determinator," a pavement testing machine.)

September, 1913

Petrolithic road construction with costs of construction and maintenance. By K. F. Postle. Pp. 246–251. (Durability—petrolithic tamping roller necessary—need for study of traffic conditions—petrolithic gang rooter.)

Macadam road construction statistics. By John McNeal. Pp. 253–255. (Cost per square yard of macadam road in Easton Pa., for 1907–1909, inclusive—cost per square yard for repairs.)

October, 1913

Manufacture of paving brick from furnace slag. P. 359. (Method—cars used for carrying slag.)

Concrete road organization. By G. F. Haskell. Pp. 359–361.

California highway improvements. By R. M. Horton. Pp. 361–363. (Importance of Grade—roads between 10 and 14 feet wide are uneconomical—value of efficient equipment.)

November, 1913

Concrete roads. Pp. 408–414. (Abstract of papers by F. F. Rogers and P. E. Green. Inspection of various roads in Wayne County, Mich.)

Proper construction of road embankments. By Geo. C. Warren. Pp. 424–429. (Method of making fills—inspection of certain bitulithic pavements.)

Cost of hauling with road roller. By R. G. Griffith. P. 458. (Itemized statement of cost data.)

December, 1913

The Chevy Chase Experimental Road. Pp. 511–514. (Description of work on various sections.)

FROM "MUNICIPAL JOURNAL"

January 2, 1913

Road traffic and treatment. By Col. Wm. D. Sohier. (American Road Builders' Association.) Pp. 24–25. (Knowledge of traffic essential to wise selection of pavement—traffic census—life of various materials.)

January 30, 1913

Concrete pavement at Marshalltown, Iowa. By H. J. Rodgers. Pp. 155–156. (Low contract prices secured partly by not requiring maintenance bond—tar paper used for transverse and middle longitudinal contraction joints—method of constructing.)

New Jersey road report. (From Annual Report State Road Commissioner, 1912.) Pp. 159–160. (Meeting maintenance costs—results of experiments with various kinds of road surfacing—maximum curvature permissible.)

February 6, 1913

Maine State Highway report. Pp. 204–205. (Recommendations of road legislation in Maine by U. S. Office of Public Roads permanent construction for well located roads only—maintenance—State-aid—records

February 13, 1913

Road building machine. Pp. 240–241. (Description of machine for excavating, mixing, spreading and rolling.)

February 20, 1913

Repairing cement-concrete pavements. By F. F. Rogers. (American Association for the Advancement of Science.) Pp. 271–272. (Actual experience in Michigan—repairing with cement mortar and with tar—most of wear at joints, especially when not protected by Steel plates. Ann Arbor tar dressing renewed annually.)

February 27, 1913

Bituminous gravel concrete pavements. By S. J. Stewart (American Association for the Advancement of Science.) Pp. 297–298. (Moderate priced surface for suburban roads—gravel and asphalt heated separately mixed mechanically and spread with shovels—covered with clay and gravel screenings, after rolling.)

March 6, 1913

Sand vs. concrete foundations for brick pavements. By Robert Hoffman (American Association for the Advancement of Science.) Pp. 323–325. (Relative economy as calculated from experiences in Cleveland—sinking fund and interest payments required by each—concrete generally more economical and effective.)

Street maintenance cost. By Jos. E. English. Pp. 326–327.. (Discussion of increase of cost with age of pavement—data from Trenton—advantage of municipal repairing.)

Bituminous gravel concrete pavements . (Continued.) By S. J. Stewart (American Association for the Advancement of Science.) Pp. 327–329. (Characteristics of gravel used—addition of asphalt increases stability and durability—low cost of construction—other advantages.)

Bituminous carpet surfaces. By A. W. Dean. (American Association for the Advancement of Science.) Pp. 330–331. (Serviceability depends upon road crust, carpet itself and character of traffic—steel tires destroy it rapidly.)

Oil macadam pavement. By F. E. Hobson (Southern Oregon Good Roads Association.) Pp. 331–332. (Description of pavement laid by City of Grants Pass, Oregon—important details of construction—importance of supervision.)

Pavements and traffic preference. Pp. 332–333. (Census of traffic on heavily traveled roads to determine choice of drivers between stone and wood block.)

Paving work done in 1912. Pp. 337–354. (Figures showing each kind of roadway and sidewalk paving laid in 1912 and contemplated for 1913—paving assessments.)

March 13, 1913

Brick pavements for country roads. By Wm. C. Perkins. (American Association for the Advancement of Science.) Pp. 379–381. (100 miles laid by New York State in vicinity of Buffalo—standard sections of State Highway Commission—use of wire-cut-lug bricks—combined brick and earth roads.)

March 20, 1913

Brick pavements for country roads. (Continued.). By Wm. C. Perkins. (American Association for the Advancement of Science.) (Pp. 413–415. (Details of construction methods—concrete base, sand cushion, cement filler and expansion joints—itemized costs.)

March 27, 1913

Brooklyn's city traffic census. By W. H. Messenger. (American Association for the Advancement of Science.) Pp. 442–443. (Forms used by observers—expressing density in standard form by use of traffic coefficients—weights of vehicles.)

April 17, 1913

Original paving done throughout United States during 1912. Pp. 556–557.

May 1, 1913

The long clove-Haverstraw State highway. Pp. 601–604. (Construction on slope of steep talus, the only site available, unusually difficult—building retaining walls on steep slopes—backfilled with hand-laid stone—asphalt macadam surface.)

Asphaltic concrete in Queens Borough. Pp. 605–608. (An average rate of construction of a mile a day—method of constructing, using old macadam as foundation—contractors' plants and methods—piling sand and stone during winter.)

State quarries in Washington. Pp. 611–612. (Five operated by State to supply broken stone for roads—plant at each—financial statement of one.)

State highway data. Pp. 612–614. (State-aid appropriations and expenditures—payments by State, county and township—use of convict labor—road mileage, total, improved and State aid—miles of improved road per capita.)

Classification of State aid roads. Pp. 614–615. (Amount of each of several kinds constructed in 1912—waterbound and bituminous macadam, gravel, and sand-clay road.)

Administration of State road work. Report of Joint Committee on Federal Aid. Pp. 615–618. (State and local administrative organizations—taxing abutting property—rural population, assessed valuation, population per mile of road, etc.)

Symposium of federal aid ideas. Pp. 619–624. (Opinions of 40 road officials and other concerning federal aid in road construction—class of roads to receive federal aid—amount to be given for construction or maintenance.)

Highway costs. (Editorial.) Pp. 625–626. (Need for improvement in keeping accounts.)

Minnesota's new road law. (Editorial.) P. 626.

May 15, 1913

Maintenance of asphalt pavements. By F. P. Smith. (Graduate course, Highway Engineering, Columbia University.) Pp. 679–680. (Discussion of defects due to wear and tear of traffic, deterioration of bituminous material and defects in construction—repairing by cutting out and by surface heating.)

Classifying road expenditures. By W. W. Crosby. Pp. 686–687. (Method of accounting adopted by the Maryland State Roads Commission—desirability of better method of recording road costs.)

May 22, 1913

Maintenance of asphalt pavements (Continued.) Pp. 712–714. (results of defects in foundation, binder and surface—cracking, disintegration, waviness, and scaling—methods of making repairs.)

Additional street paving data received since publication of tables in issue of March 6, 1913. Pp. 716–717. (Resurfacing in 1912—work contemplated for 1913.)

May 29, 1913

The scientific selection of pavements. By Maj. W. W. Crosby. Pp. 737–738. (Selection based on experience, expressed in figures, rather than on mere opinions—qualities of pavements classified under 11 heads and values assigned to them—illustrations of use.)

Bituminous gravel pavement defects. Pp. 739. (Due chiefly to absence of deliberate proportioning, which results in non-uniformity and often in too rich or too dry a mix.)

June 19, 1913

Durax (or Kleinpflaster) pavement in the Brooklyn Navy Yard. By W. H. Allen. Pp. 849–850. (First pavement of this kind to be laid in the United States—concrete foundation given very smooth surface—half-inch cushion of chips—stones used are 3-inch cubes.)

Bituminous-gravel concrete pavements. By J. W. Howard. Pp. 851–852. (Reasons for failure of such road surfaces—clay film on gravel and poorly graded sizes.)

Automobiles and macadam maintenance. By Charles F. Lawton. P. 852. (Effect of automobile traffic on the cost of maintaining macadam roads—figures from actual experience in a Massachusetts City.)

Paving earthwork computations. By F. C. Snow. Pp. 855–856, 858. (Diagrams used for computing volume of excavation for street paving, using various forms of field notes.)

July 10, 1913

Mixing plants for bituminous concrete. By A. F. Gruenenthal (American Association for Advancement of Science.) Pp. 41–44. (Permanent portable and semi-portable plants used by 5 contractors for work on roads in Queens Borough—description of 9 plants—relative economy of the 3 types—chemical tests at plants.)

Bituminous-gravel pavements. By S. J. Stewart. P. 48. (See also P. 74, July 17, 1913.) (Discussion regarding specifications and method of construction of roads of this type.)

July 17, 1913

Asphalt macadam in Nassau County, Long Island, N. Y. P. 74. (Resurfacing by penetration method—no rolling except on final surface of screenings—method of conducting work.)

July 31, 1913

Minnesota State Commission recommends 7200 miles of county roads. P. 135.

August 21, 1913

International Road Congress. (Abstract from paper by A. H. Blanchard.) (North Carolina Good Roads Association, 1913 Convention.) Pp. 239–240. (Conditions of membership in International Association—conclusions of the Congress—which are of special interest to Americans.)

August 28, 1913

Comparative cost of automobiles and horses. Pp. 268-273. (Figures from 46 cities giving actual cost of maintenance during past year—salaries, upkeep, repairs, supplies—automobiles in every case cheaper than horse-drawn apparatus.)

September 4, 1913

New York apportionment of highway fund (among counties in State.) P. 322.

Illinois counties' road apportionments. P. 324.

September 11, 1913

Examinations for highway superintendents. P. 354. (Illinois State highway commission examination.)

September 25, 1913

New York State highway work. Pp. 409-413. (Brick and bituminous concrete near Rochester—brick paving on the Jamison Road—bituminous grouted macadam on the Wales Center-Wales Road—material, appliances and methods used on each.)

Wisconsin State Highway Commission. Pp. 413-416. (Methods of organizing work and instructing foremen—modifications of present State law desirable—forms for cost data, kept by foremen and county and State highway commissioners.)

Milwaukee County roads. Pp. 417-419. (Material available for paving favors use of concrete—equipment owned by county—transporting materials—expansion joints.)

Wayne County roads. Pp. 419-421. (Present condition of 4-year old concrete roads—construction methods and appliances—costs—concrete mixed very wet—making the armored joints—use and storage of material handling machinery.)

Chicago, Illinois county roads. Pp. 421-422. (Macadam constructed within city limits—use of gasolene road rollers—maintenance—light vs. heavy oil.)

Ohio heavy traffic brick. Pp. 422-426. (Highest character of construction—methods and costs—bituminated concrete road at Canal Winchester—mixture hauled in automobile trucks—water-bound macadam steel constructed—specifications for present construction.)

What kinds of roads to build. (Editorial.) P. 427. (From Ohio State Road Commission bulletin.)

Details of construction all-important. (Editorial.) P. 427.

Roads of Allegheny County, Pa. P. 429. (Maintained by applying oil by both gravity and pressure—asphalt macadam on concrete—mechanical mix bituminous concrete.)

October 30, 1913

Embankment in road construction. By George C. Warren. (Annual Convention, American Society of Municipal Improvements.) Pp. 587-589. (Embankment should always be rolled in thin layers as in reservior construction—otherwise settlement likely to occur, even months afterwards, to the detriment of any pavement laid—illustrations of both practices.)

December 4, 1913

Pennsylvania State highways. Pp. 755–759. (Organization of department—relocation and reconstruction of Lewistown Narrows Road—laying asphaltic concrete surface—reconstruction problems—work near Philadelphia and Harrisburg.)

New York Highway organization. Pp. 763–764. Scheme for reorganization adopted—construction, maintenance and supervision under engineer—work divided geographically rather than functionally.) (Editorial.) P. 767.

Cost of concrete pavement. P. 764. (Cost of concrete road near Ft. Dodge, Iowa.

Bitulithic in two counties. Pp. 765–766. (State highways in Oneida and Herkimer Counties, N. Y.—extra width and quality paid for by municipalities.)

From "Southern Good Roads"

February, 1913

Good roads and the high cost of living. By W. W. Finley. Pp. 5–7. (Good roads open up farm lands to cultivation—need for road improvement—need for expert engineers in counties—labor taxes to be condemned.)

Experimental surfaces and special surface treatment under special conditions. By W. H. Connell. Pp. 8–11. (Value of experimental surfaces—hindrances caused by patented pavements—influence of traffic on selection of roads.)

A sampittic road at Sharptown, Maryland. By Maj. W. W. Crosby. Pp. 12–14. (Method of construction.)

Essential requisites in the making of a highway engineer. By S. A. Stephenson, Jr. Pp. 15–17. (Courses suggested for college training of engineers.)

Trunk line system of highways. By C. G. Reel. Pp. 18–20. (New York system of highways—history of organization of highway department—character of construction adopted—progress of road building in New York.)

North Carolina legislature and good roads. (Editorial.) Pp. 22–23. (Adverse criticism of legislature.)

County should be unit in road work. (Editorial.) P. 23. (Statement of reasons.)

March, 1913

"Boone Way." On to Cumberland Gap. Pp. 9–11. (Argument for improving old trail.)

Quebec-Miami International Highway. By H. D. Hadley. Pp. 12–13. (Progress in the construction of the road.)

Federal aid. By Curtis Hill. Pp. 15–16. (Favorable argument.)

April, 1913

"365-Day roads." By J. D. Clarkson. Pp. 5–8. (Advocating road improvement and constant maintenance.)

Bituminous materials for road building. By Dr. A. S. Cushman. Pp. 9–11. (Classification of road binders—testing of bitumens.)

Our road problems in South Carolina. By M. G. Holmes. Pp. 12–13. (Value of good roads—need for proper construction and maintenance influence of bad roads on illiteracy—selection of roads necessary.)

Notes on water-bound macadam. By Jas. Owen. Pp. 14–16. (Satisfactory under proper conditions.)

May, 1913

National highways. By Chas. H. Davis. Pp. 5–11. (Method of applying Federal aid—good roads conventions—discussion of bills introduced in Congress calling for Federal aid—comparison of Federal expenditures for various purposes—suggestionsfor a Federal aid bill.)

Bituminous gravel concrete pavements. By S. J. Stewart. Pp. 12–15. (Selection of types controlled by traffic—description of the bitumen—gravel—cost data.)

A motor truck on a mountain road. By N. Buckner. Pp. 16–17. (Trucks used in building construction in mountains—description of truck.)

The perfect country road—how to get it. By Thos. H. King. Pp. 18–19. (Proper construction of earth roads—classes of ordinary traffic—need for wide tires—traction engines.)

June, 1913

The relation of public roads to farm economics. By L. W. Page. Pp. 5–8. (Method of financing roads—need for traffic censuses—farm surveys—relation to highway traffic surveys—length of haul—value of road improvement—saving in hauling.)

The good roads germ. By L. L. Robinson. Pp. 9–10. (Progress of good roads movement-relation of roads to advance of civilization—widespread interest in road questions.)

Hon. Jonathan Bourne's federal aid plan. Pp. 11–13. (Discussion of bill proposed by Joint Committee on Federal Aid.)

July, 1913

Highways of western North Carolina. By Jos. H. Pratt. Pp. 13–18. (Progress of road building—description of various roads.)

August, 1913

Road management. By L. I. Hewes. Pp. 5–9. (Methods prevailing up to 1892 and in New Jersey since then—typical local administration—need for effective organization—need for civil engineers as executives—examination and classification of roads first necessary step—need for proper bookkeeping—importance of maintenance—road management in New York.)

What improved roads mean to a town. By C. C. Gilbert. Pp. 13–14. (Bad roads more expensive than improved roads—improved roads mean more activity for busy cities—poor roads lead to limited social life, illiteracy, small church attendance—value of good roads to farmer.)

September, 1913

Third American Road Congress at Detroit, September 29–October 4, resolutions, delegates, papers, proceedings. P. 5–8.

Slag in highway construction. By S. Jacobs. Pp. 9–11. (Production of blast furnace slag—sulphur not harmful—chemical content—southern slag best quality—saving in transportation—slag a natural cement—plenty of water needed—roller must be used freely—slag better than stone.)

The South's big advantage. By D. T. Pierce. Pp. 12–13. (South can profit by experience of northern States—experiments show cheap work more expensive in long run than roads requiring large first expenditure.

Why convicts should be worked on the public roads. By H. B. Varner. Pp. 22–23. (Convicts furnished to railroads for private uses—State should have benefit of their labor.)

October, 1913

Fifth annual convention of the Southern Appalachian Good Roads Association, October 22–23. Pp. 5–6. (Membership—topics for discussion.)

Good roads proclamation. By Locke Craig, Governor of North Carolina. Pp. 7–8. (Setting aside 2 days as good roads days.)

Highway construction in southwest Virginia. By C. B. Scott. Pp. 13–15. (Progress of road building in various counties.)

Road building system of Dillon County, S. C. By E. M. Wayland. Pp. 16–18. (History of road progress since 1911.)

November, 1913

Relation of the State to highway improvement. By W. W. Finley. Pp. 5–6. (Highways essential to prosperity, especially agricultural—State highway departments should collect data about roads in State—convict labor best used on highways—selection of postal routes.)

Some impressions of the American Road Congress. By J. H. Pratt. Pp. 7–8. (Resolutions passed.)

The Old National Pike. By Miss Alma Rittenberry. Pp. 9–10. (Historical data.)

Proceedings of Southern Appalachian Good Roads Convention, October 22–23. Pp. 14–17.

December, 1913

Describing highway construction in Tazewell County, Virginia. By W. I. Lee. Pp. 5–7. (Bond issues—organisation of county work.)

The relationship of colleges and universities to the good roads movement. By E. K. Graham. Pp. 8–10. (Highway engineering courses question of good citizenship—roads, schools and churches related as issues—farm tenancy—road movement part of civilized progress.)

Roads and their insistent users. By A. G. Batchelder. Pp. 11–12. (Scenic beauties opened up by good roads—automobiles—federal aid.)

Problems of construction—maintenance. By J. F. Witt. P. 12. (Selection of roads—surfacing materials—drainage—maintenance—road patrolling bond issues.)

Modern road building in the United States. By Major W. W. Crosby. Pp. 13–16. (Construction of permanent drainage structures—concrete structures—construction of macadam roads—use of limestone screenings—bituminous materials in road building.)

Annual convention Alabama Good Roads Association. Pp. 17–18. (Proceedings.)

A. A. A. again declares for federal aid. P. 19.

From "Manufacturers' Record"

October 2, 1913

A north and south highway. (Advantages of such a highway.)

October 23, 1913

Reasons why through trunk highways are needed—Quebec-Miami International Highway. By Fred. F. Smith. (Route and description of present condition of highway.)

October 30, 1913

The present road problem. By Major W. W. Crosby. (Urges expenditures of funds derived from bond issued promptly, economically and efficiently and suggests how this may be accomplished.)

November 6, 1913

More than $6,000,000 for highways. By N. B. ReMine. (Provision for improved roads within radius of 100 miles of Bristol, Tennessee.)

November 13, 1913

Bring the next American Road Congress to the South. (Editorial.)

December 4, 1913

Slag for highways. By Chas. E. Chidsey. (Satisfactory results obtained in Mississippi.)

December 11, 1913

South wins American Road Congress. (Next meeting to be held in Atlanta.)

December 25, 1913

Permanency essential in road building. By C. C. Gilbert.

HIGHWAY ENGINEERING EDUCATION

Agricultural and Mechanical College of Texas, College Station, Texas

The course consists of three lecture periods per week, of one hour each, during one semester of the junior year. This course covers general elementary study of the subject of country roads and city pavements; character of materials and types of construction; location and drainage of roads; maintenance; road laws; finances; organization and supervision. *Textbook on Highway Engineering*, Blanchard and Drowne.

In addition to the regular course the College also offers a four-weeks winter course for road supervisors and county surveyors covering practical features of the work.—ROBERT J. POTTS, Professor of Highway Engineering.

Alabama Polytechnic Institute, Auburn, Alabama

Roads and Pavements.—Five hours a week for fifteen weeks is devoted to class room instruction in economic principles involved in road improvement—analysis of resistance to traction—location, grades, and drainage of new roads; relocation and improvement of existing roads; construction and maintenance of earth, gravel and macadam roads; bituminous materials in road construction; street plans; width and grade of streets; curbs and gutters; construction of and comparative merit of various kinds of street pavements; construction of sidewalks; street drainage.

Road Materials Laboratory.—Three hours per week for ten weeks. Tests are made of the various road materials to determine physical properties and relative merits of the various materials used in highway construction.

Road and Street Improvement.—Three hours per week for eleven weeks in making surveys, plans and estimates for road and street improvements.

Special One Year Course for Road Foremen and Inspectors.—Elementary work in mathematics, drawing, surveying, and shop work.—JOHN J. WILMORE, Dean of Engineering.

Armour Institute of Technology, Chicago, Illinois

The course is given in the first semester of the senior year, covering a period of eighteen weeks, three hours per week. The study includes economic theory of the location and construction of country roads; design, construction, and maintenance of city streets and pavements, and a study of the various materials for road building and for streets and pavements.

Byrnes' *Highway Construction* is used as a text, supplemented by lectures, library references and inspection trips to paving work on Chicago Streets.—H. M. RAYMOND, Dean.

Brown University, Providence, Rhode Island

The course covers economics and theory of location and construction of country highways. Emphasis is placed on the relative advantages of the different forms of modern surfaces for country highways; and the adaptability of the different forms of surfaces for city work. Methods of testing various road materials are taught by lecture.

Field trips are required for the purpose of inspecting the many forms of pavements existing about Providence. The work is taught in three hours per week during the second semester of the junior year.—JOHN E. HILL. Professor of Civil Engineering.

Bucknell University, Lewisburg, Pennsylvania

The economic location, design and construction of roads and pavements are considered, comparisons being made between the various methods and materials. Sections of roads and streets are surveyed and from the notes taken plans, specifications and estimates for construction and paving are prepared. The instruction is given in the first term, junior civil engineering, five hours.—C. A. LINDEMANN.

Christian Brothers College, St. Louis, Missouri

Roads and Pavements.—A practical course in road building and street paving. Inspection of work in process of construction.—B. W. LAWRENCE, President.

Cornell University, Ithaca, New York

First Term, Fifteen periods, Fourth Year.—Lecture and recitation course covering methods of construction and maintenance of standard types of roads and pavements.

Second Term, Forty-five Periods, Fourth Year.—Elective course. Lectures recitations and problems covering prevailing methods of location, construction and maintenance of roads and the economics, construction and maintenance of city pavements.—E. E. HASKELL, Dean.

Columbia University, New York City

The graduate course in highway engineering, leading to the master's degree, comprises sixteen courses, equivalent to one academic year of twenty recitation periods per week. The course is given from December to March inclusive, hence, as a residence of one collegiate year is required before the master's degree will be awarded, it is necessary for graduate students in highway engineering to be in residence during two winter periods or the equivalent thereof. All the courses, with the exception of two seminar courses are given in periods of from two to four weeks.

The several graduate courses are: Highway engineering 101—Economics and design of roads and pavements; 102—Broken Stone, gravel and other roads; brick, stone block, wood block, and cement concrete pavements; 103—Bituminous surfaces and bituminous pavements; 104—Highway jurisprudence, highway laws and systems of administration; 105—Highway bridges and culverts; 106—Management engineering; 107—Mechanical appliances used in highway engineering; 108—Non-bituminous road materials, laboratory course; 109—Road surveying and design; 110—Street surveying and design; 111 and 112—Seminars in highway engineering literature: Chemistry H-199—Mining, manufacture, testing and inspection of bituminous materials; H-200—Testing of bituminous materials, laboratory course: Geology H-215—Engineering geology; H-216—Lithology and petrology.

Instruction is given by lectures, seminars, laboratory and library research work, and inspection trips. Besides a special corps of permanent officers of instruction, from twenty to twenty-five non-resident lecturers in highway engineering give lectures in special fields in which they are recognised specialists.

Equipment includes laboratories for the testing of bituminous and non-bituminous highway materials.—Arthur H. Blanchard, Professor of Highway Engineering.

George Washington University, Washington, D. C.

The course in highways and pavements consist of two lectures a week for the second half of the sophomore year. The course is limited to the science of road surfacing, maintenance and repairs, with brief reference to municipal engineering, street locations and surfacing. A preceding course includes work in the cement testing laboratory, and other courses give work in surveys, locations, bridges, culverts, etc.—O. A. Mechlin, Professor-in-Charge.

Harvard University, Cambridge, Massachusetts

This course consists of twenty-five lectures upon the construction and maintenance of roads and pavements. It is assumed that, in preparation, the student has adequate knowledge of curves, earth work computations, and such elementary principles of mechanics as are applicable to railroads and roads.—Hector J. Hughes, Chairman, School of Engineering.

Howard University, Washington, D. C.

Roads and Pavements.—One hour per week, first half year. Study of good roads problems, traffic over country roads and city streets and best methods of construction and maintenance for earth, gravel and broken stone roads. Text: Baker's *Roads and Pavements.*—P. B. Perkins, Director.

Iowa State College, Ames, Iowa

Beginning with the collegiate year 1913-1914 students in Civil Engineering were offered special instruction in Highway Engineering, and those who elect to do so may begin in the second semester of their junior year to take a series of correlated courses covering Highway economics; Systems of administration for state and county road work; Methods of promoting and financing highway construction: Types of roads and pavements; Methods of construction and cost of roads and pavements; Expert reports; Taking and interpreting the traffic census; Design of roads and pavements; Tests of road building materials, including bituminous materials.

The Iowa highway commission has its office at the college, and by coöperation between the civil engineering department and the commission students are often enabled to get summer work on highway construction, or as inspectors of highway bridge construction.—T. R. Agg, Assistant Professor in Civil Engineering, R. A.

Lafayette College, Easton, Pennsylvania

Roads and Pavements.—Location, construction and maintenance of town and country roads, city streets and pavements; street cleaning. Second term, junior year, two periods of one hour each per week. This term extends over eleven weeks.

Road Material Laboratory.—Standard tests of paving brick, and a test on road metal by the Deval machine. We hope to install in the near future a new laboratory for the testing of petroleums, malthas, tars and asphalts. The equipment will be that recommended in Bulletin No. 38 of the Office of Public Roads.—William T. Lyle, Professor of Municipal Engineering.

Lehigh University, South Bethlehem, Pennsylvania

Instruction in highway engineering is given to the students in the junior class of the civil engineering department. It consists of two recitations each week for one-half of a college year, in all about thirty-two recitations, supplemented by lectures on highway engineering given by engineers in practice. Each student taking this course has also courses in masonry construction, bridge work, drainage, railway location and instruction in laying out curves and computing earthwork.—FRANK P. MCKIBBEN, Professor of Civil Engineering.

Loyola University, Chicago, Illinois

The course of instruction consists of lectures, recitations, collateral reading, and visits of inspection of road works under construction in this locality. The course includes location, construction and maintenance of roads, and the construction and maintenance of city streets and pavements. A. A. NEFF, Dean of Engineering.

Maryland Agricultural College, College Park, Maryland

Four periods a week for one term are given to the theory of highway engineering. Such part of eight periods as is necessary is given to practice in the field. This involves reconnaissance, preliminary, location and relocation surveys and includes setting of grade stakes, computation of quantities, etc.

Attention is given in certain other courses to matters pertaining to highway engineering. The subject of highway bridges and culverts is treated in structural design and lectures and laboratory practice on cement and concrete are given during one term.—T. H. TALIAFERRO.

Massachusetts Institute of Technology, Boston, Massachusetts

Highway Engineering.—Course consists of fifteen lectures during second term of third year. It comprises an outline of the principles governing location, construction, and maintenance of roads, and construction and maintenance of the various kinds of pavements for city streets. The textbook is Baker's work on *Roads and Pavements.*

Roadway Construction.—Two hours of lectures or conferences per week accompanied by extensive assigned reading, inspection of road construction examinations of reports and cost records.

Road Bitumens and Binders.—A course of fifteen lectures and thirty hours in the laboratory in the second term. This course deals with applications and tests of bitumens, tars, oils, paints and chemicals used in preservation of roads and road structures.

Surveying and Plotting.—A course of fifteen two-hour exercises per term throughout the second year consisting of lectures and recitations supplemented by exercises in field and drafting-room. Field work is confined to use of tape, compass, transit and level. Work in drafting-room consists in making computations, scale drawings, profiles and contour maps and studying their application to the solution of engineering problems. Textbook is *The Principles and Practice of Surveying* by Professors Breed and Hosmer, Volume 1.

Plane Surveying.—This course given at the summer camp consists of field-work supplemented by lectures and work in drafting-room. Field work consists in making surveys with compass and chain and with the transit and tape, running of profiles and cross-sectioning with level, use of solar attachment to transit, and in astronomical determination of a meridan.

Work in drafting-room consists in making computations which arise in surveying operations and in making scale drawings, profiles and contour maps from field-notes. Textbook is *The Principles and Practice of Surveying* by Professors Breed and Hosmer, Volume 1.

Topographic Surveying.—This course given at the summer camp consists of lectures, field-work and work in drafting-room.

Field-work consists in making plane and topographic surveys with stadia transit, making of large and small scale maps with plane table, use of sextant in hydrographic surveys, use of traverse plane table in making road traverses for small scale maps, use of barometer for determining differences in elevation, and in determination of azimuth angles by solar observations.

Textbook is *The Principles and Practice of Surveying* by Professors Breed and Hosmer, Volume 2.

Advanced Surveying.—This course of thirty hours in first term of third year is devoted to construction of stadia diagrams, completion of computations and map work taken during summer, and in making of topographic maps from surveys made with camera.—CHARLES M. SPOFFORD, Professor of Civil Engineering.

Michigan Agricultural College, East Lansing, Michigan.

Road Construction.—Two recitation hours. Six hours field work per week. Spring term of ten weeks. Described as the principles and practice of highway location, construction and maintenance. Required of seniors in the forestry course.

Agricultural Engineering.—Winter term, five lecture hours per week. Treats principally of systems of drainage, construction and improvement of highways and ordinary highway bridges.—C. W. BISSELL, Dean.

New York University, New York City

A course embodying the general principles of highway construction. It includes a study of preliminary and location surveys, foundations, paving materials, consideration of the suitability of various types of roads, dust prevention, street cleaning and maintenance, and side-walk construction. Sophomore, first term. Lectures or recitations, two hours. Textbook *Highway Engineering*, by Morrison.—CHAS. H. SNOW, Dean.

North Dakota Agricultural College, Fargo, North Dakota

Highway Improvement.—A condensed course in highway construction and maintenance. Special attention is given to the care of earth roads. Three credits for one semester.

Economics of Highway Construction.—Economic and social advantages of improved roads; the traffic census; local and centralized systems of control; highway laws; organization of construction and engineering forces; cost data; methods of handling work; forms of contract, etc. Three credits for one semester.—R. H. SLOCUM, PROFESSOR OF ENGINEERING.

Norwich University, Northfield, Vermont

The course aims to give the methods of location and construction of country roads. Studies of the various types of state standards are made and much emphasis is placed on the drainage problems.

Methods of testing road materials and bituminous binders are taught by lectures and laboratory demonstrations. Surfacing of city streets, foundations, etc., are made a careful study. ARTHUR E. WINSLOW, Department of Civil Engineering.

The Ohio State University, Columbus, Ohio

Highway engineering is given in junior year under the general title of civil engineering on roads and streets. The course runs eighteen weeks and is given three hours of lecture and recitation work per week. The textbook employed is Baker's. In addition to the text assignments students are required to make from thirty to fifty readings of selected articles on highway work from the engineering publications and magazines. The instructor takes the classes out for several short trips to inspect the streets of Columbus and vicinity.—EDWARD ORTON, Dean.

Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma

Instruction consists of three recitations per week for ten weeks. Textbook, Spaulding's *Roads and Pavements*. We are just fitting out the laboratory for the testing of road materials, containing the usual machines for standard tests. We give also the usual instruction in surveying, computation of earth work, etc., in connection with the civil engineering course.—ALFRED BOYD, Professor of Civil Engineering.

Oregon Agricultural College, Corvallis, Oregon

Highway Engineering.—Economic grades and proper location for different soils and surfacing materials; surface and sub-surface drainage; culvert design and construction; construction and maintenance of earth, sand-clay oiled earth, gravel and macadam roads; dust preventives and road binders; preliminary surveys and estimates; specifications; elective three credits for one semester.

Highway Improvement.—A condensed course in highway construction and maintenance. Special attention is given to the care of earth roads. The course is especially arranged to meet the needs of those interested in roads in country districts. Three credits for one semester.

Economics of Highway Construction.—Economic and social advantages of improved roads; the traffic census; local and centralized systems of control; highway laws; organization of construction and engineering forces; cost data; methods of handling work; forms of contract, etc. Three credits for one semester—GORDON V. SKELTON, Professor of Engineering.

The Pennsylvania State College, State College, Pennsylvania

Highway engineering is taught in a full four year undergraduate course, essentially a course in civil engineering, but modified by changes in the, latter part so that more time is made available for strictly highway engineering branches. The specialized work in highway engineering, beginning at the middle of the junior year and continuing to the end of the senior year, is as follows: two hours of recitations and lectures per week for one semester in theory of roads and pavements, four hours per week for one semester in laboratory testing of bituminous road materials; and about six hours per week through one year devoted to the necessary surveys, and drawings and computations for the design and estimate of cost for the improvement and reconstruction of a section of a street or road. For experimental and practical study of road building the School of Engineering has available a 12-ton Monarch steam roller, a road grader, a stone crusher, and screens. There are also several log drags, road hones, plows, etc. The laboratory equipment consists of a 4-cylinder Deval abrasion machine, a Dorrey type abrasion machine, a Page impact testing machine for testing toughness of rock, a Page ball mill, briquette machine, and a Page impact machine for testing cementation value of rock, a diamond core drill, a diamond saw, and a 9-inch grinding lap. The laboratory for testing bituminous materials is fully equipped with the usual pycnometers, glass retorts, beakers, flasks, etc., and a Cleveland oil tester, Engler viscosimeter, Dow penetration machine and numerous pieces of minor apparatus necessary to carry on all the usual tests on bituminous materials. In conjunction with the forestry department a creosoting plant is available for treating wood for wood pavements. Experiments are conducted in the uses of dust preventives, the student doing the actual work of sprinkling and treating the road surface.—JOHN P. JACKSON, Dean.

Polytechnic Institute of Brooklyn, Brooklyn, New York

The instruction in highway engineering is given during one semester of fifteen weeks, two periods per week. The course consists essentially of oral and blackboard class-room recitations on textbook matter, practically all of Blanchard Drowne's "Text Book on Highway Eng." being covered. Problems are assigned for solution out of class-hours. Inspection trips are made for the purpose of examining the various types of pavements and for studying methods of construction. Monthly written quizzes are held and a final examination is given at the end of the term.—C. W. HUDSON, Professor of Civil Engineering.

Purdue University, Lafayette, Indiana

Under municipal engineering a six weeks course is offered in highway engineering. It consists of six lectures and eighteen hours of field and drafting work. In addition, the course in testing materials includes the testing of road materials, such as broken stone, gravel cement, concrete and paving brick, by standard methods. An optional course for one semester is offered in the senior year, consisting of two lectures and three drafting room hours per week, covering highway engineering.—W. K. HATT, Professor of Engineering.

Rensselar Polytechnic Institute, Troy, New York

Class-room work includes instruction in economics of roads and pavements; design of grades and of sub-division of a property into streets and lots; surveys for roads and pavements; design and construction of drains, bridges, culverts, race tracks, equestrian roads, curbs, and sidewalks; design, specifications for and construction of macadam, telford, bituminous macadam, asphalt, brick, stone block and wooden block pavements.

The discussion of bridges and surveys for roads and pavements is given outside of the recitations above mentioned. In the field work the practice covers the methods of laying out streets and lots, grading and giving lines and grades for curbs and pavement surfaces.

In the laboratory the work is as follows: tests of cements and mortars; paving brick tests; macadam tests; abrasion tests in the Deval abrasion cylinders; toughness tests; hardness tests; and tests of bituminous road materials.

Rhode Island State College, Kingston, Rhode Island

The course in highway engineering covers four hours per week for one-half year, three being recitations and lectures and one two-hour period per week for field and laboratory work. The textbook is by Howard Frost. Our field work consists in making a location survey for a piece of road, making a profile, calculating the quantities of cut and fill and cost of construction.

The subject of bridges is studied separately, six hours per week Culverts and arches are studied under the head of masonry.—S. H. WEBSTER, Professor of Engineering.

Rose Polytechnic Institute, Terre Haute, Indiana

The course on roads and pavements is given to the civil engineering students for one hour a week during the second term of the junior year. The work consists of lectures and recitations with a small amount of laboratory work on the inspection and identification of road materials. We have been using Baker's *Roads and Pavements* for a text-book, supplemented by the pamphlets of numerous manufacturers of paving materials. Special lectures from well known road engineers are arranged for from time to time.—C. LEO MEES, President.

Sheffield Scientific School of Yale University, New Haven, Connecticut

Undergraduate Course.—A course in roads and pavements is given in first half of senior year to all members of civil and sanitary engineering courses. The total amount of time allowed is thirty hours. Instruction is by means of textbook supplemented by assigned articles in current engineering publications. About one-half of each exercise of one hour is devoted to recitation on the subject matter of the text, and the remainder to reports on assigned articles by different members of the class. A brief description of the pavements in New Haven is furnished to each student, who is required to inspect several different kinds of pavements and to render a brief written report. Groups of three students, working in relays, make traffic observations during one twelve-hour period. Observation blanks are furnished by the city engineer of New Haven. No laboratory work is given. Two written exercises or tests are held at intervals during the term, and a final written examination is required.—C. S. FARNHAM.

Graduate Course.—A course in railroad and highway engineering, of six hours per week for nine weeks, is offered to first year graduate students in civil and sanitary engineering. Instruction is given by means of lectures which deal largely with economic location. Practice is offered by assigning a problem in location of highway or railway to each group of two or three students. About two-thirds of the time allowed for the course is spent in the field and drawing room; and a final report including rough map, grade, estimated quantities and cost is required of each student.—S. E. BARNEY.

State College of Washington, Pullman, Washington

There are two courses in highway engineering. One is an introductory course having a value of three hours. This includes a study of the location, construction and maintenance of country roads, city streets and pavements. The effect of alignment, grades, drainage and cross-contour are studied. The course is given one semester of four and one-half months.

The second course, called advanced highway engineering, has a value of five hours. This included a study of the properties of road stone and road binders, and making the test of these materials as recommended by the Office of Public Roads at Washington, D. C. (the department has a complete set of testing machines and laboratory equipment for making these tests) the origin and source of materials, the preparation of the materials for paving, and the effect of traffic and climate on the lasting qualities of the materials. Each class is required to make a model road to the scale of 1½ inch to the foot from some given material. The course is given one semester consisting of two recitations and three three-hour laboratory periods. Text, Byrnes' *Highway Construction*, Richardson's *Asphalt Pavements, etc.*

The State University of Iowa, Iowa City, Iowa

The course in highways and highway engineering given is as follows: Location, construction and maintenance of country highways and city streets and walks, cleaning of city streets and methods of assessing costs of construction. The course consists of three recitations for nine weeks. Bridges and culverts are covered in course on structures.—WM. G. RAYMOND, Dean.

State University of Kentucky. Lexington, Kentucky

Two free scholarships are awarded by the fiscal court of each county.

Appointments to this course are good only for rural and highway engineering.

Highway Location: Principles and methods followed in locating highways. Location of several miles of road, five hours per week, first term. Highway Construction: Methods of construction, materials to be used. Determining the size and kind of culverts, bridges and other openings on roadways; methods of determining the final quantities, five hours per week, third term. Highway Maintenance. Lectures, assigned readings and reports. Inspection of roads in the vicinity of the University, three hours per week, second term.—PROFESSORS ROWE and TERRELL.

Swarthmore College, Swarthmore, Pennsylvania

Roads and Building Materials.—Lectures, recitations and laboratory tests. The lectures and recitations deal with the construction of roads and pavements. The value of different materials, cost, upkeep, etc., with specifications, proper proportions, methods of inspection and testing. The laboratory work consists of tests of sands, mortars, cement, concrete, brick, etc. Texts, Byrne's *Highway Construction* and Carpenter's *Experimental Engineering.*—JOESPH SWAIN, President.

Thayer School of Civil Engineering, Hanover, New Hampshire

A brief technical course is given on the theory and practice of highway construction, using for this purpose Baker's *Roads and Pavements*. The time devoted to it is less than thirty half-days. and instruction is given merely by consecutive recitations from the textbook. Our work in surveying covers all the necessary features of highway surveying in another connection entirely apart from this textbook course. We have the usual laboratory for testing materials, and thorough courses on materials of construction, cement, concrete, reinforced concrete (theory) and concrete structures, including culverts and bridges. Ordinary wooden and steel bridges are studied by text-book (in a separate course) as to analysis of stresses; and by inspections and designing, as to details.—ROBERT FLETCHER DIRECTOR.

Throop College of Technology, Pasadena, California

The prescribed course in highway engineering for civil engineering students consists of one recitation a week during the first half of the third year. The work covered includes: the design, construction, and maintenance of country roads and city streets, with special attention given to bituminous construction; specifications; methods of financing, and assessment of costs. Highway structures are studied under bridge design.—FRANKLIN THOMAS, Associate Professor of Civil Engineering.

Tufts College, Massachusetts

Highways.—The course is conducted by lectures, recitations and laboratory work during three hours per week for a half year. It includes drainage foundations; earth and broken stone roads; paving material, including asphalt and concrete; use of dust palliatives; cleaning and sanitation; pipe systems; and road machinery. Laboratory tests are made on sand, cement and paving material.

Office and field work comprise the preparation of plan and cross sections from survey notes of an existing unimproved road; location of a highway from contour plan; actual survey, design and mapping of streets including determination of proper grades at street intersections; inspection of roads. Text-book: *American Civil Engineers' Pocketbook.*—GARDNER C. ANTHONY, Dean Engineering School.

University of Alabama, Tuscaloosa, Alabama

During the past year the four-year civil engineering course has been revised and made to include the subjects of road location and construction, paving materials, pavement construction, the design of highway culverts and bridges and the testing of road materials, most of which subjects have in the past been open to special students in highway engineering only. In addition, a two-year course has been inaugurated, which is planned to prepare the students for the positions of superintendent of road and pavement construction. In addition to the fundamental studies of the regular four-year courses this course includes the subjects of general geology, petrology, steam and other engines, masonry, roads and pavements, and a general course in municipal engineering.

The road materials laboratory, in connection with the physical and cement testing laboratories, the geological department of the University, and the State Geological Survey Collections and equipment, is intended to afford facilities for the study of the road materials of Alabama and to furnish students with a research laboratory as well as instruction in the physical properties and usefulness of the various kinds of roads materials. GEO. JACOB DAVIS, JR., Dean.

University of Arkansas, Fayetteville, Arkansas

Road and Pavements.—Primarily for third year students in civil engineering. Required of all candidates for degree in civil engineering. The location, construction and maintenance of earth, macadam, telford, and sand-clay roads. Pavements for city streets. A two hour course for one year.

Laboratory.—Testing of road materials. Four year students. One hour for half year.—J. J. KNOCH, Professor Civil Engineering.

University of California, Berkeley, California

Instruction in highway engineering is given in two courses: a lecture and a laboratory course. The lecture course is given by Prof. Charles Gilman Hyde. The laboratory course is offered under the joint direction of Prof. C. Alvarez and Prof. Horace S. Griswold.

Lecture Course.—The lecture course is known as "highway engineering," (course C. E. 106) and is prescribed in the junior year for all students in the railroad and irrigation engineering courses. The course embraces two lectures per week during one term of fifteen weeks, and deals with road and pavement economics; location; construction and maintenance of earth, gravel and broken stone roads, both with and without the use of bituminous and other materials; design, construction and maintenance of pavements; Text is Baker's *Roads and Pavements.* The course requires three mid-term written reviews and a final written examination.

Laboratory Course.—The laboratory course covers testing of rock, oils, asphalts and paving brick. Laboratory work covers two 4 hour periods per week for a term of fourteen weeks.—PROFESSORS HYDE, GRISWOLD and ALVAREZ.

University of Georgia, Athens, Georgia

The regular four-year course in civil engineering offers a three hour per week option in highway engineering with additional work in road material laboratory and field surveys.

A good roads department is in operation for road extension work under three officers, one of them employed constantly in the field offers advice and assistance by correspondence and by visits to Georgia counties—makes examination of road materials free of cost; makes surveys for relocations and bridge sites; prepares designs for bridges and culverts upon request; prepares specifications and legal advertisements for bridge lettings; inspects bridges in advance of acceptance; inspects dangerous structures; makes public addresses; offers a special ten-day course at Athens for road officials; offers a one-year course on highways to mature men contemplating employment as road officers.—C. M. STRAHAN, Dean, School Civil Engineering.

University of Idaho, Moscow, Idaho

In the civil engineering course a two-credit course for one semester is given on roads and pavements, requiring two class periods per week of recitation, lecture, drawing or field work. Instruction necessary for a highway engineer is given in connection with many other courses, such as surveying, drafting, testing laboratory, and structural engineering. In addition to this work, the Department, with the assistance of the U. S. Office of Public Roads, carried out the program of a short school for road overseers, March 12-14, 1913.—C. N. LITTLE, Dean.

University of Illinois, Urbana, Illinois

The special instruction in highway engineering at present consists of two recitations per week for eighteen weeks in the third year. In this work Baker's *Roads and Pavements* is used as a textbook.—IRA O. BAKER, Professor of Civil Engineering.

University of Kansas, Lawrence, Kansas

The course of highway engineering is a half-year's work in roads and pavements in the junior year, in addition some little work is done in a small laboratory for testing road materials.—R. B. H. BEGG, Professor of Engineering.

University of Maine, Orono, Maine

Highway Engineering.—The two semester hour course in roads and pavements heretofore given has been modified and increased to five semester hours given in three courses: (1) municipal engineering, a two unit course offered in the third year, embracing city planning, economics, drainage, construction and maintenance of pavements, sewerage and water supply; highway engineering, a two-hour course for the fourth year on location, relocation, drainage, construction and maintenance of country roads and highways, highway economics, legislation and administration; road material testing laboratory, a one-unit course for the fourth year for the testing of bituminous and non-bituminous road materials. A complete laboratory equipped with the latest types of road materials testing machinery has been provided jointly by the Maine State highway commission and the University, and is located at the University, where the tests for materials used in state highway work are performed.

University of Michigan, Ann Arbor

Roads and Pavements. Two hours both semesters. Location, construction and maintenance of country and suburban roads. Grades for pavements and roads, estimates of cost, street railway construction in paved streets, materials for paving, brick, asphalt, stone, wood and bituminous paving, foundations, road and pavement economics. This course is required of all civil engineering students.

Advanced Highway Engineering. Two hours, second semester only. A seminary course in highway engineering taking up a study of the most recent literature on the general problems of good roads, especially outside of large cities; State aid laws; State highway organizations.

Highway Laboratory. Two hours both semesters. Testing of cement, analysis of sand and gravel for concrete road construction, tests of rock for road building, including hardness, toughness, abrasion and cementation. Tests of paving brick. Study and tests of bituminous materials for road binders and of asphalt paving compositions.

Equipment.—The University has a fully equipped highway laboratory. The laboratory is practically a duplicate of the Washington laboratory of the Office of Public Roads, Department of Agriculture.—HENRY E. RIGGS, Professor of Civil Engineering; WILLIAM C. HOOD, Professor of Sanitary and Municipal Engineering; JOHN J. COX; Instructor in Highway Engineering.

The University of Minnesota, Minneapolis, Minnesota

A course is given in roads and pavements in the second semester of the junior year. During the first half of the semester, work consists of recitations and lectures on road location and construction. Many problems and reference readings on actual practice of construction are assigned. In the second half of the semester inspection of work in progress on the roads tributary to the Twin Cities and of pavements being laid in the cities is made. Both the asphalt and timber creasoting plants of Minneapolis are visited by the students. In the new Experimental Building space has been assigned for tests on road material and some apparatus is already in place. The general course in civil engineering includes surveying, methods of computing earthwork, masonry and steel structures, hydraulics, geology, economics of transportation, etc.—FRANCIS C. SHENEHON, Dean.

University of Mississippi, Oxford, Mississippi

A lecture course in highway engineering extends over two terms, class meets three times each week. Laboratory work, testing road materials is carried on in connection with this course. Another course, in road surveying ing and estimating occupies one term-three periods each week.

In a course in reinforced concrete, special attention is given to design of bridges and culverts, design of waterways being considered in connection with drainage engineering and sewerage. Other related subjects, as masonry and structural engineering, are treated by lectures and laboratory experimentation.—J. H. Dorroh,

University of Missouri, Columbia, Missouri

The courses in highway engineering are as follows: Roads and pavements an elementary course given by recitations from textbook supplemented by lectures, two periods per week for one semester. Required of all students in civil engineering. Highway engineering, a more advanced course, conducted mainly as seminar work, references are given to sources of information, and reports required of the students on various assigned topics with discussion before the class. A part of the time is used in textbook study of bituminous roads. Two periods per week for one semester. Elective to students who have had the first course. Testing road materials, a laboratory course covering the ordinary tests of rock for road purposes, and for bitumens. One period a week for one semester. Elective. Highway structures, a design course, comprising design of culverts and small bridges, mainly in concrete, including a reinforced concrete arch. Two periods a week for one semester. Elective for seniors.—F. P. Spalding, Professor of Civil Engineering.

Montana State College, University of Montana, Bozeman Montana

Highway Engineering.—A course of highway engineering is given during the first semesters and deals with the location, construction and maintenance of highways. Water, salts, emulsions, tars, and bitumens as binders and dust preventatives. Tests of highway materials. Traffic data in relation to type of road. Methods of drainage, including types of culverts and area of water way. Patented types. Federal, State and county aid. Highway laws. A study of traction, sanitation, radiation of light and heat, slipperiness, ease of cleaning, repairing, etc. This course is laid out for students in civil engineering.—A. W. Richter, Dean.

The University of Nebraska, Lincoln, Nebraska

Roads and Pavements.—A course of readings, lectures and recitations covering the location, alignment, drainage construction and maintenance of earth, sand-clay, gravel, macadam, telford, concrete and bituminous roads. Modern methods of dust prevention are studied under maintenance.

Testing Road Materials.—Lectures and laboratory. This is a study of various kinds of road making materials; the laboratory being equipped for the usual tests.

Cement and Concrete Testing.—Lectures and laboratory. Classification, composition, manufacture, inspection and sampling of cements. Specifications for mixing and using. Practical testing of cement mortars and concretes. The laboratory is equipped for making all the standard tests.—Geo. R. Chatburn, Professor of Applied Mechanics in charge of Highway Engineering.

University of Nevada, Reno, Nevada

The course occupies two class periods and two laboratory periods per week for one semester of eighteen weeks and the time devoted to highway engineering and closely related subjects occupies about thirty to forty per cent of that devoted to the total course.

The class treatment is based largely on Baker's *Roads and Pavements* with reference readings from government and other recent pamphlets.—H. P. Boardman, Professor of Civil Engineering.

University of Notre Dame, Notre Dame, Indiana

The course is given in the senior year to the civil engineering students, and is studied four hours a week for sixteen weeks. The class-room work includes recitations and lectures, on drainage, location, grades, and the materials used in road construction, the paving materials examined as to wearing, strength and other properties, and most approved method of maintenance. Instruction is given as to plans and specifications, and the advantages of improved highways. Students do field work and prepare plans, profiles and specifications of a proposed highway after making the necessary survey and leveling. Visits of inspection are made when possible.—M. J. McCue, Dean.

University of Oregon, Eugene, Oregon

Roads and Pavements.—Survey and location of roads; grades; drainage; foundations; road coverings; crushed rock and gravel. Stone, wood, asphalt, and brick pavements; laying out city streets; footwalks, curbs, gutters, maintenance, repair, cleaning, and watering. The equivalent of two hours of recitations per week will be required. On the basis of three hours for each recitation replaced, outdoor work will be arranged according to the weather. Open to students of senior standing. Two hours, both semesters.—E. H. McAllister, Dean College of Engineering.

University of Pennsylvania, Philadelphia, Pennsylvania

Two hours a week for the first half of the senior year are devoted to the subject of roads and pavements. The instruction on this subject is based on a text-book, supplemented by lectures. For purpose of recitations the class is divided into sections and frequent written tests are held. No special test in the testing of road materials is offered, but three hours a week for half of the senior year are devoted to tests of cement and concrete and three hours a week for one-half of the junior year to the testing of the materials of construction in general, including stone, wood, paving brick, etc.—Edgar Marburg, Professor-in-Charge.

University of Pittsburgh, Pittsburgh, Pennsylvania

Roads and Pavements.—A study of the location, width and transverse section of roads and streets, together with a study of the materials used and methods of constructing, repairing and improving the surfaces of roads and pavements. Two recitations of one hour each from an assigned text and collateral reading with three hours laboratory work per week for the last term (twelve weeks) of the senior year; required of all civil engineering students. The laboratory work included determination tests of the various properties of road materials, the efficiency of binders and dust preventives.—F. L. Bishop, Dean.

University of the South, Sewanee, Tennessee

Highway engineering is covered briefly in the junior following a course in railroad construction and economics. Special attention is given to proper methods of construction of Highways with sand, clay, and macadam.—Ben Coulson, Head of the Department of Engineering.

University of Southern California, Los Angeles, California

The course in highway engineering is given in the last half year of the four year course in civil engineering. It consists of two hour periods per week of recitations based on Baker's *Highway Engineering*, and is supplemented by readings and lectures on allied subjects. Observations of methods of construction are made on the work of the Los Angeles County good road system and of the work of the State highway commission.—C. W. Lawrence, Professor of Civil Engineering.

University of South Carolina, Columbia, South Carolina

Roads and Pavements.—Lectures and recitations on the principles of road location; the construction and maintenance of earth, gravel, sand-clay and macadam roads; pavements for city streets and sidewalks. The class is given practical problems in road location and construction. First term, three hours per week.

Dust Preventives.—This course comprises five lectures, the study of standard authors, field observations and a written report covering the range of the subject. Reading matter will be assigned to the students at the end of their second year, and the five lectures will occur during the first term of the third year.—M. G. Homes, Professor of Engineering.

University of Tennessee, Knoxville, Tennessee

A short course in highway engineering was inaugurated in 1914, comprising lectures on road building, selection of route, establishing grades, ditching, culverts, selection of road covering, etc. It is the purpose of this course to make the student familiar with the work now being done by the U. S. Office of Public Roads, and by road departments of various States. The University is equipping a laboratory for testing road materials.

University of Texas, Austin, Texas

The course in highway engineering deals with the location, construction and maintenance of roads, streets and pavements; the economy of good roads with their advantages, the methods of maintaining roads and their economical management. The instruction is given in the spring term of the junior civil engineering, three hours per week.—T. U. Taylor, Dean of Engineering.

University of Utah, Salt Lake City, Utah

The course given in roads and pavements covers two hours' recitation work per week and Baker's *Roads and Pavements* is used as a basis for the course. Reports are required of students from the current engineering magazines and the reports of the engineering societies.—R. B. Ketchum, Professor of Engineering.

University of Vermont, Burlington, Vermont

The instruction in highway engineering comprises a three-hour course given in the second half of the senior year. It covers textbook and lecture work accompanied by laboratory work in testing of road materials, and field work in road surveys, the laying out of work, plans, estimates and specifications.—J. W. Volty, Dean.

University of Washington, Seattle, Washington

Four courses directly relating to highway engineering are given in the University of Washington. A brief outline of these courses follows.

Course 70: Highways.—This is a course of two hours per week running through a semester and required of all juniors in civil engineering. It covers a general survey of the location, construction and maintenance of country roads and city streets, and a study of alignment and grades in comparison with the same subjects as applied to railroad work. The study of drainage, foundations and methods of construction of the cheaper roads of earth, sand, clay and gravel occupy about two-thirds of the time given to this subject. Some of the fundamental economic principles involved in financing highways are discussed and emphasized.

Course 71: Highway Construction.—This is a course of four hours per week for one semester for the seniors in civil engineering who desire to specialize in highway work. The course deals more fully with the economics of highway location, construction and maintenance and involves the consideration and study of highways of permanent character. Each student is expected to perform all the standard laboratory tests of highway metals.

Course 18: Road Oils and Tars.—This is a two hour course throughout a semester and is offered by the department of chemistry for students in highway engineering. One lecture and one laboratory period are devoted to the work. It involves a study of the compostion and properties of all road binding materials.—E. J. McCaustland, Professor of Municipal and Highway Engineering.

University of Wisconsin, Madison, Wisconsin

Roads and Pavements 101.—This course covers the construction, maintenance and administration of earth roads, gravel roads, and the simpler forms of macadam road. Special attention will be devoted to the Wisconsin highway laws. Lectures, theme writing and inspections. One hour credit. First semester.

Roads and Pavements 102.—Economics and design of roads and pavements The text is Blanchard's "Highway Engineering." Library work, reports and theme writing on assigned subjects are also required. Topics covered are history of roads and pavements; economics of highway engineering; preliminary investigations, traffic census, drainage, foundations, general design of roads and streets, hygienic aspect of dust, cleaning city streets, effect of various kinds of vehicles on roads, etc., bituminous surfaces and bituminous pavements, macadam, brick, stone, wood block and cement pavements. This course is offered each semester.

Roads and Pavements 103.—Special and detail study is made of the most important problems involved in the construction and maintenance of roads and pavements. Inspection trips are made to neighboring cities. Each student prepares a design and estimate of cost of some road or street based upon a survey or a topographic map furnished him. Given each semester.

Roads and Pavements 104.—This course consists of laboratory work on testing road material both in the chemical and pavement laboratories. Two credits. Second semester.—Prerequisites for this course is Course 101 or its equivalent.

Highway Bridges and Culverts 111.—Lectures and problems in design work covering the standard types of pipe, box and arch culverts, and also standard types of wood, steel, concrete and reinforced concrete bridges.—Leonard F. Smith, in charge of Highway Engineering.

University of Wyoming, Laramie, Wyoming

Roads and Tunnels.—(a) Road economics and location, gravel, broken stone, and miscellaneous roads; street pavements, drainage, curbs and gutters, pavement foundations, asphalt, brick, cobblestone and stone-block pavements; sidewalks. Two hours. (b) Methods of surveying, tunnel machinery, timbering and lining, tunnels through hard rock and soft ground submarine tunneling, ventilation and lighting, cost of construction. Two hours.

Virginia Polytechnic Institute, Blacksburg, Virginia

Roads and Building Material.—A special set of lectures, with illustrations, is given upon the general and detailed construction of roads, city and country, pavements and drains, cost, grades, repair, etc. The points emphasized in these lectures are: Different road coverings and the best materials available for use and economy, the inspection and testing of sands, cements and mortars, their actual mixing, proper proportions, etc., with specifications and requirements for good building materials, tests and demonstrations of the peculiarities of the different road materials, with short course in concrete. Textbook, Baker's *Roads and Pavements* Harger and Bonney's *Highway Engineer Handbook.* Three times a week second term. In connection with this course is given a short course in curves, earth-work and calculating cuts and fills. Lectures on available instruments for use in building highways and comparative costs.—R. B. H. BEGG, Professor of Civil Engineering.

Washington University, St. Louis, Missouri

Roads, Streets and Pavements.—The location, drainage, construction and maintenance of streets and roads; consideration of the different paving materials in connection with their particular characteristics and their adaptability and adequacy under various conditions of service; the cost and life of pavements. Two lectures a week. First semester. Senior year.—J. L. VAN ORNUM, Professor of Engineering.

West Virginia University, Morgantown, West Virginia

The following courses in highway engineering are regularly given in the department of railway and highway engineering: Roads and pavements, primarily for fourth year students in civil engineering, three hours. Required of all candidates for degree in civil engineering. Location, construction and maintenance; study and comparison of various types of roads; road making materials; lectures, recitations and field work. Highway economics two hours. Optional for fourth year students in civil engineering Continuation of roads and pavements with special reference to permanent improvements and maintenance of existing roads. Re-surveys, re-location, drainage, etc.

The course in roads and pavements is required of all candidates for degrees of civil engineering, but for the course of highway economics the student may substitute the equivalent in hydraulic construction if he so elects. These courses follow thorough courses in surveying, railroad location, railroad construction and maintenance and accompanying courses in sanitary and water supply engineering, in which the problems relating to sewerage and drainage are considered, so that the courses in highway engineering are concentrated on the special problems to be met in the building of roads not common to other subjects.

An optional laboratory course in testing road materials has been arranged and graduate courses in highway engineering are being planned for next year.

A ten day school of good roads, of which A. D. Williams, chief engineer of the State bureau of roads is director, has been organized to comply with the act of the legislature requiring that "All county road engineers shall visit the office of the State Road Bureau at least once every year and shall receive instruction in road building for at least ten days. etc." This school is under the joint supervision of the University and the State road bureau. Tuition is free.—C. R. JONES, Dean.

Worcester Polytechnic Institute, Worcester, Massachusetts

The course in highway engineering given students in civil engineering consists of reading, recitations and lectures for one-half year, one period per week. All students taking the course have had thorough courses in surveying, railroad surveying and construction, masonry and foundations and later take courses on bridges, sewers and drains. Much of the important subject matter on road construction is taken in these subjects, but not formally as a course in highway construction.—A. W. FRENCH, Professor of Civil Engineering.

TRADE NAMES

Road Materials

Acme Asphalt: Trade name given to asphalt cement produced by Warren Brother Company, 59 Temple Place, Boston, Massachusetts (advertisement page 189).

Agasco: A refined road tar manufactured by the Atlanta Gas Light Company, Electric and Gas Building, Atlanta, Georgia.

American Ingot Iron: Used for nonrusting culverts. American Rolling Mill Company, Middletown, Ohio (advertisement page 194).

Asfaltoil: Gulf Refining Company, 514 Battery Park, New York, New York. The trade name for several grades of fluid reduced petroleums for use in the surface treatment of roads.

Asphaltoilene: Alden Speare's Sons Company, Boston, Massachusetts. The trade name of several grades of reduced and residual petroleums and oil asphalt manufactured by this company for use in hot and cold surface treatment and in the construction of roads.

Asphalt Block: For pavements. The Hastings Pavement Company, New York City (advertisement page 158).

Aztec: United States Asphalt Refining Company, 90 West Street, New York, New York. An oil asphalt produced from Mexican crude petroleum (advertisement page 184).

Bermudez Road Asphalt: Barber Asphalt Paving Company, Philadelphia, Pennsylvania. Fluxed Bermudez Lake asphalt for use in road construction (advertisement page 145).

Bicomac: Headley Good Roads Company, Real Estate Trust Building, Phildelphia, Pennsylvania. An emulsified bitumen which is diluted with water and mixed with Portland cement concrete in the surfacing of roads.

Bitulithic: Warren Brothers Company, 59 Temple Place, Boston, Massachusetts. Trade name of a patented pavement construction consisting of varying sizes of crushed stone or gravel mixed with bituminous cement, the sizes of crushed stone varying from a maximum which is about one-half the depth of the pavement surface (which surface is generally 2 inches deep) to impalpable powder, being so prepared as to give a high degree of density and low percentage of voids (advertisement page 189).

Bitustone Double Bond: A pavement construction patented by August E. Schutte of Northboro, Massachusetts, consisting of a concrete foundation of a depth of about 3½ inches, and bonding course about 1½ inches and the spaces in the bonding course filled and the surface coated with asphaltic cement, prepared for the purpose, the surface finally finished with crusher screenings or coarse sand spread into the hot bitumen The bonding course is made of neat cement and nearly uniform size stone or gravel (preferably 1 inch to 1½ inches in size), in proportion of one part cement to six parts stone or gravel (advertisement page 189).

Byerlyte: Byerley & Sons, 2484 West Fourth Street, Cleveland, Ohio. Several grades of oil asphalt for use in road construction.

Carbo-Via: Continental Bitumen Company, Toledo, Ohio. A refined coal tar product.

Chicago AA: A Brand of Portland Cement manufactured by the Chicago Portland Cement Company, Chicago and Oglesby, Illinois (advertisement page 148).

Cubanel: International Asphalt Company, Chamber of Commerce Building, Chicago, Illinois. A fluxed Cuban asphalt for use in paving and road construction.

Double Bond Cement: Warren Brothers Company, 59 Temple Place, Boston, Massachusetts. Trade name given to the asphalt cement used for the bonding course of the Bitustone Double Bond Pavement (advertisement page 189).

Dupont: Explosives for quarrying. E. I. Dupont de Nemours Powder Company, Wilmington, Delaware.

Durax: Wern Machinery and Engineering Company, 30 Church Street, New York, N. Y. The trade name for a type of pavement or road surface composed of small cubical granite blocks.

Dustoline: The Dustoline for Roads Company, Summit, New Jersey. The copyrighted, trademark name of a transparent, reddish colored compound, of refined, nonasphaltic petroleum products, used as a dust preventive and road preserver.

Fairfield: The Impervious Product Company, 400 E. Fayette Street, Baltimore, Maryland. The trade name for the products of this company, such as "Anti-Dust," "Road Binders," and "Fairfield Asphalt." The latter, which forms the basis of their other products, is said to come from a neutralized and weathered sludge acid deposit.

Glutrin: Robeson Process Company, Pennington, New Jersey. An adhesive liquor containing organic acids manufactured from the lignone compounds produced in the making of wood pulp by the sulfite process (advertisement page 172).

Hassam Pavement: Hassam Paving Company, Worcester, Massachusetts. A patented form of concrete pavement constructed by grouting the rolled stone with a fluid grout of sand and Portland cement (advertisement page 155).

Hydrolene: The Sun Company, 1421 Chestnut Street, Philadelphia, Pennsylvania. Oil asphalts for use in road construction.

Indian: Indian Refining Company, 17 Battery Place, New York. The trade name for several grades of reduced and residual petroleums and oil asphalt for use in hot and cold surface treatment and in the construction of roads.

Kyrock: Wadsworth Stone and Paving Company, Lambert Street, and Penna. R. R., Pittsburgh, Pennsylvania. A natural rock asphalt found in Kentucky (advertisement page 188).

Monarch: Sunset Monarch Oil Company of California, 60 California Street, San Francisco, Calif. The trade name for a road oil and several grades of asphalt produced from California petroleum (advertisement page 182).

Montezuma: Warner-Quinlan Asphalt Company, 79 Wall Street, New York, N. Y. Several grades of Mexican oil-asphalt for use in street and road construction.

Neuchatel: The Neuchatel Asphalte Company, Ltd., 291 Broadway, New York. A rock asphalt mined at the Val de Travers mines located at Canton of Neuchatel, Switzerland.

Prime White Road Oil: Prime White Road Oil Company, First National Bank Building, Cincinnati, Ohio. A colorless petroleum distillate for use as a dust layer.

Progressive Culverts: Combination cast iron and corrugated iron. Manufactured by American Culvert Manufacturing Company, Buechel, Kentucky.

Roadamite: Roadamite Company, 604 H. W. Hellman Building, Los Angeles, Calif. The trade name for an asphaltic cement prepared from California petroleum.

Rocmac: Haines & Teall, Inc., Philadelphia, Pa. A chemical mixture containing silicate of soda, sugar, powdered limestone, and other ingredients with which the upper course in macadam or gravel construction is puddled (advertisement page 173).

Sarco: Standard Asphalt and Rubber Company, First National Bank Building, Chicago, Illinois. Several grades of asphalt containing Gilsonite, for use in road construction (advertisement page 175).

Sarcolithic: Standard Asphalt and Rubber Company, First National Bank Building, Chicago, Illinois. The trade name for a form of pavement consisting of a graded crushed stone aggregate which is mixed with Sarco Asphaltic Cement (advertisement page 175).

Standard: Standard Oil Company of New York, and Standard Oil Company of New Jersey, 26 Broadway, New York. "Standard Refined Mexican Asphalt," "Standard Macadam Asphalt Binders," "Standard Asphalt Road Oils," prepared by this Company for use in sheet asphalt paving, bituminous macadam construction and cold surface treatment of macadam and gravel roads (advertisements pages 176 and 178).

Tarite: The American Tar Company, Malden, Massachusetts. A refined coal tar product for use in road construction. "Tarite Asphalt" is a refined coal tar containing a certain percentage of oil asphalt. "Tarine," a refined tar preparation for use in construction work or in surface treatments (advertisement page 140).

Taroid: The F. J. Lewis Manufacturing Company, 2505 South Robey Street, Chicago, Illinois. A refined coal tar product.

Tarvia: Barrett Manufacturing Company, 17 Battery Place, New York, New York. A trade name of this Company for their tar products used for road purposes. "Tarvia A" for hot surface treatment: "Tarvia B" for cold surface treatment: "Tarvia X" for penetration or mixing method in road construction (advertisement page 147).

Tasscoil: The Alden Speare's Sons Company, Boston, Massachusetts. A colorless oil distillate for use as a dust layer.

Terracolio: Headley Good Roads Company, Real Estate Trust Building, Philadelphia, Pennsylvania. An emulsified semi-asphaltic oil which may be diluted and used in the surface treatment of roads.

Texaco: The Texas Company, 17 Battery Place, New York, New York. All the Texaco road products are marketed under the registered trade name "Texaco." They are "Texaco Road Oil for Cold Application," "Texaco Road Oil for Hot Application," "Texaco Liquid Asphalt," "Texaco Macadam Binder," "Texaco Road Asphalt," "Texaco Paving Filler," "Texaco Paving Cement" (advertisement page 180).

Trinidad Liquid Asphalt: Barber Asphalt Paving Company, Land Title Building, Philadelphia, Pennsylvania. Natural liquid asphalt for the surface treatment of roads, obtained from the Island of Trinidad; "A" to be used cold; "B" to be applied hot (advertisement page 145).

Ugite: The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania. The trade name for fluid and semi-solid refined water-gas tar for use in surface treatment and construction. "No. 1" is applied cold as a dust layer; "No. 2" is applied hot for surface treatment; "No. 3" is recommended for construction by the penetration method; "No. 4" is recommended for construction by the mixing method.

Union Paving Asphalt and Maltha Brand: Union Oil Company of California, Mills Building, San Francisco. Oil asphalt refined from heavy California crudes of between 12 and 16 gravity Beaume (advertisement page 182).

Warrenite: Warren Brothers Company, 59 Temple Place, Boston, Massachusetts. A modification of the bitulithic city pavement adapted to meet the traffic conditions of country roads (advertisement page 189).

Westrumite: The Westrumite Company, Whiting, Indiana: The Alantic Westrumite Company, Washington, D. C. An aqueous emulsion of native bitumens used cold as a binder in road construction in the following ways: (1) By mixing method (2) By penetration method (3) By surface treatment (4) As a dust layer (advertisement page 190).

Road Machinery

Acme: Trade name given road machines manufactured by the Acme Road Machinery Company, Frankfort, New York (advertisement page 138).

Acme: Trade name given to metal culverts manufactured by The Canton Culvert Company, Canton, Ohio (advertisement page 195).

Ajax: Trade name given to engines used for operating crusher plants manufactured by the A. B. Farquhar Company, York, Pennsylvania (advertisement page 153).

Apex: Reversible dumpting and spreading car. Apex Wagon Company, Auburn, New York.

Atlantic: Trade name given to steam shovels manufactured by the Bucyrus Company, South Milwaukee, Wisconsin.

Atlapump: Trade name given to a pump engine manufactured by the Harold L. Bond Company, 78 H Beach Street, New York, New York.

Aurora: Trade name given to jaw rock crusher and dump wagon manufactured by the Austin-Western Company, Ltd., Karpen Building, Chicago, Illinois (advertisement page 143).

Austin: Trade name given to motor rollers, gyratory crusher, sprinkler and reversible grader manufactured by the Austin-Western Company, Ltd., Karpen Building, Chicago, Illinois (advertisement page 143).

Austin Giant: Trade name given to grader manufactured by the Austin-Western Company, Ltd., Karpen Building, Chicago, Illinois (advertisement page 143).

Automatic Concrete Mixers: Gravity mixers. By Automatic Concrete Mixer Company, New York City.

Blystone Batch Mixer: Concrete mixer. Manufactured by Blystone Machinery Company, Cambridge Springs, Pennsylvania.

Bucyrus: Trade name given to a steam shovel manufactured by the Bucyrus Company, South Milwaukee, Wisconsin.

Buffalo Pitts: Trade name given Ddl. Cyl. Two-Speed Steel Gear Road Locomotives, Contractors Special Traction Engines, Contractors Gasoline Tractors, Reversible Stone Spreading Cars—Steel Frame, Reversible Stone Spreading Cars—Wood Frame, Buffalo Pitts Road Freight Cars, and Automobile Trailers. Buffalo Pitts Company, Buffalo, New York.

Busy Bee: Trade name given to hammer drills manufactured by the McKiernan-Terry Drill Company, U. S. Realty Building, New York, New York.

Butterfly: Trade name given a rock drill manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Caterpillar: A traction engine designed to work in soft loose soils. Holt Caterpillar Company, Peoria, Illinois (advertisement page 160).

Chicago: Concrete mixer, batch type, rotary. Chicago Concrete Machinery Company, Milwaukee, Wisconsin.

Climax: Trade name given to a steel reversible road machine and a rock crusher sold by the Good Roads Machinery Company, Inc., Marathon, New York (advertisement page 156).

Climax Jumbo: Trade name given a heavy road machine sold by the Good Roads Machinery Company, Inc., Marathon, New York (advertisement page 156).

Columbian: Trade name given to dump wagons and carts manufactured by the Columbia Wagon Company, Columbia, Pennsylvania.

Cube: Trade name given to concrete mixer manufactured by the Municipal Engineering and Contracting Company, Railway Exchange Building, Chicago, Illinois.

Double Shell: Trade name given to dryers manufactured by the Ruggles-Coles Engineering Company, 50 Church Street, New York, New York.

Eagle Dump Wagon: The Eagle Wagon Works, Auburn, New York.

Electric-Air: Trade name given to rock drills manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, New York.

Eureka: Continuous concrete mixer. Eureka Machine Company, Lansing, Michigan.

Everett: Trade name given to portable dumping box manufactured by the Everett Manufacturing Company, Newark, New York.

Foote: Batch concrete mixer. Foote Manufacturing Company, Munda, New York.

Force-Feed: Trade name given to the rock crusher manufactured by the Universal Crusher Company, Box 678, Cedar Rapids, Iowa.

Glide: Trade name given to graders manufactured by the Glide Road Machine Company, Minneapolis, Minnesota.

Huber: Road rollers, tractors, dump wagons, and general road equipment. Huber Manufacturing Company, Marion, Ohio (advertisement page 161).

Hvass: Trade name given to scarifier, push brooms, street sweepers and general equipment for handling bituminous materials manufactured by the Chas. Hvass Company, East 18th and 19th Streets, Avenues A and B, New York, New York (advertisement page 159).

Imperial: Trade name given to metal culverts manufactured by the Canton Culvert Company, Canton, Ohio (advertisement page 195).

Link: Conveyors for loading and unloading crushed stone, sand, etc., from cars or dump into wagons. Link Belt Company, Philadelphia, Pennsylvania.

Little Western: Trade name given to grader manufactured by the Austin-Western Company, Ltd., Karpen Building, Chicago, Illinois (advertisement page 143.)

Little Winner: Trade name given a two-horse road machine sold by the Good Roads Machinery Company, Inc., Marathon, New York (advertisement page 156).

Lutz: Surface heater for heating asphalt pavements at time of repair. Equitable Asphalt Maintenance Company, Kansas City, Missouri.

Maney Four Wheel Scraper: Trade names given to grader and scraper manufactured by the Baker Manufacturing Company, 906–907 Exchange Building, Memphis, Tennessee.

Milburn-Blatt: Trade name given to dump wagon manufactured by the Milburn Wagon Company, Toledo, Ohio.

Mogul: Trade name given to oil tractor manufactured by the International Harvester Company of America, Harvester Building, Chicago, Illinois (advertisement page 162).

Monarch: Trade name given a combination roller and traction hauling engine sold by the Good Roads Machinery Company, Inc., Marathon, New York (advertisement page 156).

New Era: Trade name given to elevating grader manufactured by the Austin-Western Company, Ltd., Karpen Building, Chicago, Illinois (advertisement page 143).

Ohio: Scarifiers, graders, drags, dump wagons, etc. Ohio Road Machinery Company, Oberlin, Ohio.

Otto: Trade name given an engine manufactured by the Otto Gas Engine Works, 3411 Walnut Street, Philadelphia, Pennsylvania.

Panama Line: Trade name given to road graders, road drags and cast iron culvert pipe manufactured by the F. B. Zieg Manufacturing Company, Fredericktown, Ohio (advertisement page 196).

Peerless: Traction engines. Emerson, Brantingham Implement Company, Rockford, Illinois.

Pennsylvania: Trade name given to crushers manufactured by the Pennsylvania Crusher Company, Philadelphia, Pennsylvania.

Pioneer: Trade name given to dump wagon manufactured by the Austin-Western Company, Karpen Building, Chicago, Illinois (advertisement page 143).

Port Huron: Trade name given to hauling engines, spreading and dumping cars manufactured by the Port Huron Engine & Thresher Company, Port Huron, Michigan (advertisement page 171).

Reliance: Trade name given a rock crusher manufactured by the Universal Road Machinery Company, Kingston, New York (advertisement page 187).

Road King: Trade name given to a road grader manufactured by J. D. Adams & Company, Indianapolis, Indiana.

Simplex: Trade name given to concrete mixer manufactured by The Miles Manufacturing Company, Jackson, Michigan.

Simplified Continuous Mixer: Trade name given to concrete mixer manufactured by Besser Manufacturing Company, Alpena, Michigan.

Smith: Rotary batch concrete mixers. T. L. Smith Company, Milwaukee, Wisconsin.

Standard: Trade name given a road roller manufactured by the Port Huron Engine & Thresher Company, Port Huron, Michigan (advertisement page 171).

Studebaker: Wagons, sprinklers, dump wagons, tank wagons, etc. Studebaker, South Bend, Indiana.

Tarco: Trade name given to road oiling appliances manufactured by the Tarrant Manufacturing Company, Saratoga Springs, New York.

Titan: Trade name given to oil tractors and road rollers manufactured by the International Harvester Company of America, Harvester Building, Chicago, Illinois (advertisement page 162).

The Big-an-Little: Trade name given to concrete mixers manufactured by the Jaeger Machine Company, Columbus, Ohio (advertisement page 164).

The Standard: Trade name given to a mixer manufactured by the Standard Scale & Supply Company, 243 Water Street, Pittsburgh, Pennsylvania.

The Susquehanna: Trade name given to a dump wagon manufactured by the Columbia Wagon Company, Columbia, Pennsylvania.

20th Century Grader: Trade name given to grader and scraper manufactured by The Baker Manufacturing Company, 906–907 Exchange Building, Memphis, Tennessee.

Vortex: Trade name given to pump engine manufactured by the Lawrence Pump & Engine Company, Lawrence, Massachusetts.

Vulcan: Trade names given to steam shovels manufactured by the Bucyrus Company, South Milwaukee, Wisconsin.

Watson: Dump wagons, trailers, etc. Watson Wagon Company, Canastota, New York.

Western: Trade name given to elevating grader manufactured by the Austin-Western Company, Ltd., Karpen Building, Chicago, Illinois (advertisement page 143).

Western Special: Trade name given to grader manufactured by the Austin-Western Company, Ltd., Karpen Building, Chicago, Illinois (advertisement page 143).

Western Standard: Trade name given to grader manufactured by the Austin-Western Company, Ltd., Karpen Building, Chicago, Illinois (advertisement page 143).

OFFICE OF PUBLIC ROADS, UNITED STATES DEPARTMENT OF AGRICULTURE

The Office of Road Inquiry was established under act of congress, approved March 3, 1893, making an appropriation of $10,000 for the Department of Agriculture.

The original law provided for making inquiries in regard to systems of road management, best methods of road making, preparation of publications, and for assisting agricultural colleges and experiment stations in disseminating information on the subject. In 1897 the investigation of road materials was authorized. In 1899 the name of the office was changed to "Public Road Inquiries." In 1901, provision was made for conducting experiments in the city of Washington and elsewhere. In 1902 investigations relating to the chemical and physical character of road materials were authorized. In 1905 the name of the office was again changed to "Office of Public Roads," and a statutory organization was provided. In 1909 the rent or purchase of road machinery was forbidden.

In 1910 the lump fund appropriation was subdivided into road management inquiries, road building and maintenance investigations, road material investigations and administrative expenses.

In 1911-12 a special appropriation of $10,000 was made for conducting field experiments and authority was given to rent or purchase machinery required in connection therewith. The appropriation for this work was increased to $30,000 for 1912-13, and to $45,000 for 1913-14. The following is a table of appropriations from the establishment of the office to the fiscal year 1913-14; and includes the estimates reported by the committee on agriculture of the house of representatives for the fiscal year 1914-15.

Appropriations from 1893-4 to 1913-14

1893-94	$10,000	1904-05	$35,000
1894-95	10,000	1905-06	50,000
1895-96	10,000	1906-07	70,000
1896-97	8,000	1907-08	70,050
1897-98	8,000	1908-09	87,390
1898-99	8,000	1909-10	116,460
1899-1900	8,000	1910-11	114,240
1900-01	14,000	1911-12	160,720
1901-02	20,000	1912-13	212,120
1902-03	30,000	1913-14	279,400
1903-04	35,000	1914-15 (pending)	353,060
			$1,709,440

In the Post Office Appropriation Bill for 1912–13, an appropriation of $500,000 was made for coöperation with States in the improvement of post roads; conditioned upon the States expending $2 for each $1 expended by the Government, the roads to be constructed under the direction of the Secretary of Agriculture. In 1913–14 the appropriation for post roads was continued and made available until expended.

TABLES OF QUANTITIES, WEIGHTS AND MEASUREMENTS FOR USE IN ROAD WORK

Crushed Stone Required per Mile of Macadam Road

WIDTH, FEET	THICKNESS COMPACTED, INCHES	TONS OF STONE REQUIRED
8	4	875
	6	1,312.50
	8	1,750
	10	2,187.50
	12	2,625
9	4	984.37
	6	1,476.56
	8	1,968.75
	10	2,460.94
	12	2,953.12
10	4	1,093.75
	6	1,640.62
	8	2,187.50
	10	2,734.37
	12	3,281.25
12	4	1,312.50
	6	1,968.75
	8	2,625
	10	3,281.25
	12	3,937.50
14	4	1,531.25
	6	2,296.87
	8	3,062.50
	10	3,828.12
	12	4,593.75
15	4	1,640.62
	6	2,460.94
	8	3,281.25
	10	4,101.56
	12	4,921.87
16	4	1,750
	6	2,625
	8	3,500
	10	4,375
	12	5,250

Number of Square Yards in One Mile of Road

WIDTH, FEET	SQUARE YARDS
8	4,693.33
10	5,866.66
12	7,040
14	8,213.33
16	9,386.66
18	10,560

Cubic Yards of Gravel for Constructing One Mile of Road

WIDTH, FEET	THICKNESS COMPACTED, INCHES	CUBIC YARDS GRAVEL, COMPACTED	CUBIC YARDS GRAVEL LOOSE
8	6	782.22	1173.33
	7	912.59	1368.88
	8	1142.93	1564.39
	9	1173.33	1760.00
	10	1303.70	1955.55
9	6	880.00	1320.00
	7	1026.67	1540.00
	8	1173.33	1760.00
	9	1320.00	1980.00
	10	1466.66	2200.00
10	6	977.77	1466.65
	7	1140.74	1711.11
	8	1303.70	1955.55
	9	1466.67	2200.00
	10	1629.63	2444.44
12	6	1173.33	1760.00
	7	1368.88	2053.32
	8	1564.44	1346.66
	9	1760.00	2640.00
	10	1955.55	2933.32
14	6	1368.88	2053.32
	7	1597.04	2595.56
	8	1825.19	2737.78
	9	2053.33	3079.99
	10	2281.44	3422.16
15	6	1466.67	2200.00
	7	1711.11	2566.66
	8	1955.55	2933.32
	9	2200.00	3300.00
	10	2444.44	3666.66
16	6	1564.44	2346.66
	7	1825.19	2737.78
	8	2085.93	3128.89
	9	2346.67	3520.00
	10	2607.41	3911.11

ROAD ASSOCIATIONS

Permanent International Association of Road Congresses

Officer.—M. Mahieu, secretary-general, 1 Avenue d'Iena, Paris, France.

1. OBJECT AND ORGANIZATION OF THE ASSOCIATION

ARTICLE I

The object of the Permanent International Association of Road Congresses is to promote progress in the construction, traffic and exploitation of roads.

It continues the work of the first International Road Congress held in Paris in October, 1908.

It accomplishes its object: 1, By organising Road Congresses; 2, by publishing papers, proceedings, and other documents; 3, by collecting the results of (*a*) tests carried out on roads; (*b*) laboratory tests throughout the world on materials which are used or are suitable for road construction and maintenance; these tests may be either in the form of mere records collected by the Association or they may have been carried out by the Association itself or through its instrumentality.

Its affairs are managed by a Permanent International Commission.

ARTICLE II

The Association consists of:

1. Delegates of Governments and Corporations of all the countries which subscribe annually to the Association.

2. Private Members.

Membership may be either permanent or temporary.

Governments may appoint one official delegate, with a right to vote at every Congress, for each 250 francs of their annual subsidy.

This amount is reduced to 100 francs for Corporations.

Permanent Members are entitled to attend and vote at every Congress.

Temporary members are entitled to attend the particular Congress they have joined, and they may vote on all questions which do not affect the Permanent Association itself.

3. Honorary Members, nominated by the Permanent International Commission.

ARTICLE III

1. A Permanent International Commission, with headquarters at Paris, is at the head of the Association.

2. A Permanent Council and an Executive Committee are appointed from amongst the Members of this Commission.

ARTICLE IV

The Permanent International Commission is composed of members belonging to the various countries represented in the Association. Each country has the right to one representative for each 1000 francs of its total annual subsidy.

Provided, however, that the number of representatives from any one country shall not exceed 15 (fifteen), and that any country which pays not less than 250 francs shall have the right to appoint one delegate.[1]

American Highway Association

Officers.—L. W. Page, director, U. S. Office of Public Roads, Washington, D. C., president; Fairfax Harrison, president, Southern Railway Company, Washington, D. C., vice-president; J. E. Pennybacker, Colorado Building, Washington, D. C., secretary; Lee McClung, New York, treasurer; James S. Harlan, member Interstate Commerce Commission, Washington, D. C., chairman, board of directors; Charles P. Light, Colorado Building, Washington, D. C., field secretary. Executive committee: Fairfax Harrison, chairman; Alfred Noble, New York; L. W. Page, Washington, D. C.; George C. Diehl, Buffalo, New York; and B. F. Yoakum, New York.

Headquarters.—708 Colorado Building, Washington, D. C.

American Road Builders' Association

Officers.—W. A. McLean, president, Toronto, Canada; E. L. Powers, secretary, New York; W. W. Crosby, treasurer, Baltimore, Maryland.

Headquarters.—150 Nassau Street, New York.

American Highway League

Officers.—A. R. Hirst, secretary, Madison Wisconsin; Thomas H. MacDonald, chairman, Iowa State College, Ames, Iowa.

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[1] For further information address either the secretary general or the American Highway Association.

American Society of Engineering Contractors

Officers.—Howard J. Cole, president; Edward Wegmann, first vice-president; George T. Clarke, second vice-president; J. R. Wemlinger, secretary, 11 Broadway, New York.

Committees.—B–10, Standard Specifications for Paving Materials, George C. Warren, chairman, 59 Temple Place, Boston, Massachusetts; C–7, Highway Construction; F. B. Bosch, chairman, Commonwealth Trust Building, Harrisburg Pennsylvania; C–8, Highway Maintenance; Carl Weber, chairman, 95 Nassau Street, New York; C–11, Bridges; Daniel B. Luten, chairman, Traction Terminal Building, Indianapolis, Indiana.

Association of Engineering Societies

Officers.—Frederick Brooks, secretary, 31 Milk Street, Boston, Massachusetts. Board of managers: Gardner S. Williams, chairman, Ann Arbor, Michigan.

Purpose.—The association exists for the purpose of publishing papers, sent in by the secretaries of the local societies, on technical subjects, including road building, but does not take the execution of work.

Automobile Chamber of Commerce

Officers.—Charles Clifton, president; W. C. Leland, first vice-president; Hugh Chalmers, W. T. White, P. H. Rice, second vice-presidents; R. D. Chapin, secretary; George Pope, treasurer; S. A. Miles, general manager, 7 East 42d Street, New York; H. A. Bonnell, assistant general manager.

American Automobile Association

Officers.—John A. Wilson, president, Franklin, Pa.; George C. Diehl, chairman good roads board, 575 Ellicott Square, Buffalo, N. Y.; A. G. Batchelder, chairman executive board, 437 Fifth Avenue, New York City.

Headquarters.—437 Fifth Avenue, New York City.

American Society of Civil Engineers

Officers.—Hunter McDonald, president; Charles Warren Hunt, secretary.

Headquarters.—220 West 57th Street, New York.

Purposes so far as they relate to roads.—Investigation and discussion of technical problems of road construction and maintenance.

American Society for Testing Materials

Officers.—A. N. Talbot, president, University of Illinois, Urbana Ill.; Edgar Marburg, secretary-treasurer, University of Pennsylvania, Philadelphia, Pennsylvania.

Committees.—On Standard Specifications for Cement: George F. Swain, chairman, Harvard University, Cambridge, Massachusetts Richard L. Humphrey, secretary, 805 Harrison Building, Philadelphia, Pennsylvania.

On Standard Specifications for Brick: A. V. Bleininger, chairman, 40th and Butler Streets, Pittsburgh, Penna.; D. E. Douty, secretary, 340 Hudson Street, New York City.

On Standard Specifications and Tests for Clay and Cement Sewer Pipe: Rudolph Hering, chairman, 170 Broadway, New York; E. J. Fort, secretary, 215 Montague Street, Brooklyn, New York.

On Standard Tests and Specifications for Drain Tile: A. Marston, chairman, Iowa State College, Ames, Iowa.

On Standard Tests for Road Materials: Logan Waller Page, chairman, Office of Public Roads, Washington, D. C.; Prevost Hubbard, secretary, Institute of Industrial Research, Washington, D. C.

Canadian Highway Association

Officers.—Hon. Thomas Taylor, Minister of Public Works, B. C., honorary president; W. J. Kerr, president, New Westminister, B. C., Frank E. Mutton Toronto, Ontario, vice-president; P. W. Luce, New Westminister, B. C., secretary; T. S. Baxter, Vancouver, B. C., treasurer.

Purpose.—This organization is not actively concerned with the actual construction and improvement of roads, but work, is mainly along educational lines.

Canadian Society of Civil Engineers

Officers.—P. Johnson, Montreal, president; H. H. Vaughan, Montreal, F. C. Gamble, Victoria, B. C., J. G. Sullivan, Winnipeg, vice-presidents; E. Marceau, Montreal, treasurer; C. H. McLeon, Montreal, secretary.

Committee on Roads.—A. W. Campbell, Deputy Minister of Railways and Canals, Ottawa, Ontario, chairman.

Capital Highway Association

Officers.—Leonard Tufts, president, Pinehurst, N. C.; John R. McQueen, secretary, Pinehurst, N. C.

Coast to Coast Highway Association

Officers.—H. Barnett, Nebraska, president; Lafayette Young, Iowa, vice-president; G. E. Parisoe, Minden, Nebr. (headquarters), secretary; E. B. Yetter, Colorado, treasurer.

Farmers' Educational and Coöperative Union of America

Officers.—Charles S. Barrett, president, Union City, Georgia; J. E. Montgomery, vice-president, Gleason, Tennessee.

Farmers' National Congress

Officers.—W. G. Ames, Oregon, Wisconsin, president; R. H. Kirby, Dallas City, Illinois, first vice-president; H. E. Stockbridge, Atlanta, Georgia, second vice-president; D. K. Unsicker, Wright, Iowa, third vice-president; O. D. Hill, Kendalia, W. Va., secretary; Levy Morrison, Greenville, Pa., treasurer; John M. Stahl, Chicago, Ill., legislative agent.

Federation of American Motorcyclists

Officers.—Dr. B. J. Patterson, Pratt, Kansas, president; G. B. Gibson, Lock Box 947, Westboro, Massachusetts, secretary-treasurer.

Good Roads Educational Association

Officers.—Frank Roden, 99 King Street, W. Toronto, Canada, president; Geo. S. Henry, Todmorden, Rural Route No. 1, Canada, treasurer; E. A. James, 57 Adelaide Street, E. Toronto, Canada, acting secretary.

International Association for Testing Materials

Officers.—Dr. Ing. N. Belelubsky, 14a Bronnitskaja, St. Petersburg, Russia, president; M. G. C. Lloyd, 28 Victoria Street, London, England, M. A. Mesnager, 182 Rue de Rivoli, Paris, France, Dr. Ing. A. Martens, Direktor des kgl. Material prufungsamtes, Berlin-Lichterfelde, Germany, vice-presidents; Ernest Reitler, secretary-general, Norbahanstrasse 50, Vienna, Austria.

Committee on Testing Materials.—M. A. Mesnager, president.

Inter-Mountain Good Roads Association

Officers.—L. P. McCalla, Boise, Idaho, president; J. C. Moore, Butte, Montana, vice-president; T. H. Burton, Nephi, Utah, secretary-treasurer; the chairman of the Board of Commissioners of each county in the States of Utah, Idaho, Montana, Wyoming Nevada and Colorado, is a vice-president.

Lincoln Highway Association

Officers.—Henry B. Joy, Detroit, Michigan, president; Carl G. Fisher, Indianapolis, Indiana, vice-president; A. R. Pardington, vice-president and secretary, Detroit, Mich.; Emory W. Clark, treasurer, Detroit, Mich.

National Highways Protective Society

Officers.—Frederic R. Coudert, President; Bradley Martin, vice-president; Col. Edward S. Cornell, 1 West 34th Street, New York, secretary; Joseph A. Herron, treasurer.

National Grange

Officers.—Oliver Wilson, master, Peoria, Illinois; N. P. Hull, lecturer, Dimondale, Michigan; C. M. Freeman, secretary, Tippecanoe City, Ohio. C. S. Stetson, chairman executive committee, Greene, Maine.

One of the Purposes.—The Grange is actively interested in the movement for better roads, particularly the movement for State and national legislation on the subject.

National Highways Association

Officers.—General Coleman du Pont, chairman board of councillors, Wilmington, Delaware; Charles Henry Davis, C. E., president, New York City, N. Y.; Frederick Remsen Hutton M. E., Sc.D., general secretary, New York City, N. Y.

Headquarters.—18 Old Slip, New York City, N. Y.

Purposes.—To bring about the building of a system of national highways.

National Old Trails Road Association

Officers.—J. M. Lowe, president, Kansas City, Missouri.

Headquarters.—222 Midland Building, Kansas City, Missouri.

National Congress of Mothers

Officers.—Mrs. Frederic Schoff, president, 3418 Baring Street, Philadelphia, Mrs. James S. Bolton, recording secretary, New Haven, Conn; Mrs. Arthur A. Birney, corresponding secretary, 806 Washington Loan and Trust Building, Washington D. C.; Mrs. W. B. Ferguson, treasurer; Logan Waller Page, Country Life Department, U. S. Department of Agriculture, Washington, D. C.

National Rural Letter Carriers' Association

Officers.—L. N. Brockway, Clinton, N. Y., president; George W. Kime Willard, Missouri, vice-president; L. H. Wilson, Olivia, Minnesota, secretary I. P. Cammarn, Upper Sandusky, Ohio, treasurer; R. E. Terry, Bavaria, Kans.; National Organizer.

Good Roads Committee: B. L. Osgood, Gaysville, Vt., secretary; John R. Smith, Marshall, Mich.; A. Russell, Monticello, Miss.

Ocean to Ocean Highway Association

Officers.—D. K. B. Sellers, Albuquerque, New Mexico, president; Fred T. Colter, Springerville, Arizona, first vice-president; J. Y. Aragon, Magdalena, New Mexico, second vice-president; C. O. Barker, Banning, California, third vice-president; John Becker, Jr., Belen, New Mexico, secretary; Frank McKee, Albuquerque, New Mexico, treasurer.

Omaha-Lincoln-Denver Trans-Continental Route

Officers.—S. A. Searle, Omaha, Nebraska, president; A. Barnett McCook, Nebraska, first vice-president; C. J. Bowlby, friend, Nebraska, second vice-president; George E. Parisoe, Minden, Nebraska, secretary; W. A. Taylor, Hastings, Nebraska, treasurer.

Pacific Highway Association of North America

Officers.—J. T. Roland, Seattle, Washington, life president; Samuel Hill, Portland, Oregon, president; Frank M. Fretwell, Seattle, Washington, secretary; H. L. Bowlby, Salem, Oregon, executive officer.

Pacific Coast Good Roads Association

Officer.—George E. Boos, Medford, Oregon, secretary.

Quebec-Miami International Highway Association

Officers.—Howard D. Hadley, president, Plattsburgh, New York, George A. Simard, vice-president, care Franco-American Chemical Company, Montreal, P. Q.; N. M. Parrott, secretary, 733 Calvert Building, Baltimore, Md.

Southern Commercial Congress

Officers.—Duncan U. Fletcher, president; Clarence J. Owens, managing director; William H. Saunders, resident director, Chas. D. Douglas, general counsel.

Headquarters.—Southern Building, Washington, D. C.

Purposes.—Relating to road improvement. To encourage the movement for the construction of good roads and for the extension of railroad and trolley transportation.

Southern National Highway

Officers.—Colonel Dell M. Potter of Clifton, Arizona, president; Colonel Bennehan Cameron of Stagville, North Carolina, general vice-president; Mr. D. R. Ellis of Clifton, Arizona, secretary; and Mr. E. W. Jackson of San Diego, California, treasurer.

Headquarters.—Clifton, Arizona.

Society for the Promotion of Engineering Education

Officers.—G. C. Anthony, Tufts College, Massachusetts, president; H. S. Jacoby, Ithaca, New York, and D. C. Humphreys, Lexington, Virginia, vice-presidents; Henry H. Norris, Cornell University, Ithaca, New York, secretary; William O. Wiley, New York, treasurer.

Santa Fe, Grand Canyon and Needles National Highway Association

Officers.—Dr. Johnson R. Whiteside, Kingman, Arizona, President; E. F. Thompson, Kingman, Arizona, secretary; R. P. Wheellock, Kingman, Arizona, assistant-secretary; M. L. Powers, Flagstaff, Arizona, treasurer.

Southern Appalachian Good Roads Association

Officers.—Joseph Hyde Pratt, Chapel Hill, N. C., president and treasurer; H. B. Varner, Lexington, North Carolina, secretary.

The Travelers Protective Association of America

Officers.—George S. Armstrong, Merchantville, N. J., president; T. S. Logan, St. Louis, Mo., secretary and treasurer.

Good Roads and Public Utilities Committee.—E. B. Smith, Shreveport, Louisiana, chairman.

Twin City-Aberdeen-Yellowstone Park Trail

Officers.—J. E. Prindle, Ismay, Montana, president; J. W. Parmley, Ipswich, South Dakota, first vice-president; G. A. Will, Minneapolis, Minnesota, second vice-president; F. A. Finch, Lemmon, South Dakota, secretary-treasurer.

The New Santa Fe Trail Association

Officers.—R. H. Faxon, Wichita, Kansas, president; C. H. Scott, Hutchinson, Kansas, secretary-treasurer; H. H. Taylor, Hutchinson, Kansas, official pilot.

State and Local Organizations

Alabama

Alabama Good Roads Association, John Craft, president, Mobile.

Alabama Association of Highway Engineers, W. P. Moore, president, Meridian, Mississippi; R. P. Boyd, secretary, Montgomery.

Alabama Convict Improvement Association, Frank S. White, chairman, Birmingham; John W. O'Neill, secretary.

Birmingham-Montgomery Highway Association, W. S. Keller, president, Montgomery; Barney M. Roberst, secretary, Clanton.

Montgomery-Lowndes-Dallas Highway Association, W. D. McCurdy, president, Lowndesboro; J. T. Jackson, secretary, Benton.

Calhoun County Good Roads Association, W. T. Goodlet, secretary, Jacksonville.

Clarke County Good Roads Association, A. B. Tucker, president, Thomasville.

Colbert County Good Roads Association, J. E. Isbell, president, Tuscumbia.

Dallas County Good Roads Association, Clifton Kirkpatrick, president, Cahaba.

Elmore County Good Roads Association, H. H. Golson, secretary, Wetumpka.

Etowah County Good Roads Association, W. P. Archer, president, Gadsden, J. L. Irving, secretary, Gadsden.

Franklin County Good Roads Association, J. Gassier, president, R. F. D. Russellville; J. C. Norwood, secretary, Russellville.

Henry County Good Roads Association, Hon. J. R. Ward, president, Abbeville.

Houston County Good Roads Association, W. R. Flowers, president, Dothan.

Jefferson County Good Roads Association, John W. O'Neill, president, Birmingham; J. A. Rountree, secretary-treasurer, Birmingham.

Lauderdale County Good Roads Association, Florence.

Madison County Rural Letter Carriers' Association, Arthur P. Dean, president, Huntsville.

Talladega County Good Roads Association, A. L. McElderry, president, Talladega.

Arizona

Arizona Good Roads Association, T. G. Norris, president, Prescott; M. A. Fraser, secretary, Prescott.

Northern Arizona Good Roads Association, M. I. Powers, president, Flagstaff; C. B. Wilson, secretary, Flagstaff.

Borderland Route Association, W. M. Adamson, vice-president, Douglas; E. P. Grindell, secretary.

Warren District Club, Good Roads Committee, John J. Bowen, chairman, Bisbee.

Mohave County Good Roads Association, Dr. John R. Whitesides, president, Kingman; E. F. Thompson, secretary-treasurer.

Arkansas

Arkansas Good Roads and Drainage Association, Harry E. Cook, president, Lake Village.

Little Rock-Texarkana Highway Association, W. Y. Foster, president, Hope.

Crawford County Roads Association, Dr. J. E. Blakemore, president, Van Buren.

Sharp County Good Roads Association, Thomas J. Wood, president, Evening Shade.

St. Francis County Branch of Memphis-Little Rock Highway Association, James Scott, president, Forrest City.

Washington County Good Roads Association, C. E. Pritchard, president, Fayetteville.

Woodruff County Good Roads Association, T. L. Gardner, Augusta.

Colorado

Arkansas, Rio Grande, Gunnison & Grande River Highway Association, C. R. McLain, president, Canon City.

Central Colorado Highway Association, L. E. Curtis, president, Colorado Springs.

Colorado Good Roads Convention, L. E. Curtis, president, Colorado Springs; W. H. Emmons, secretary, Chamber of Commerce Building, Denver.

Colorado Road Builders Association, R. H. Higgins, president, Pueblo; E. E. Sommers, vice-president, Denver; T. W. Monell, secretary-treasurer, Montrose.

Greater Colorado Highway Association, E. E. Sommers, president, Denver;

Arapahoe County Good Roads Association, Littleton.

El Paso County Good Roads Association, Colorado Springs.

Fremont County Good Roads Association, Canon City.

Jefferson County Good Roads Association, Golden.

La Plata County Good Roads Association, Chamber of Commerce, Durango.

Las Animas County Good Roads Association, Trinidad.

Park County Good Roads Association, Fairplay.

Pitkin County Good Roads Association, Aspen.

Prowers County Good Roads Association, Holly.

Rio Blanco County Good Roads Association, Meeker.

San Juan County Good Roads Association, Chamber of Commerce, Silverton.

Weld County Good Roads Association, Ault & Greeley.

Connecticut

Association of Connecticut Road Builders, Hartford, W. Scott Eames, president, New Haven; Robert E. Mitchell, vice-president, Williamantic; R. J. Ross. secretary-treasurer, Hartford.

Connecticut Good Roads Association, 902 Chapel St., Room 701, New Haven, Henry A. Bishop, president, Bridgeport; Don C. Seitz, 1st vice-president, Greenwich; Wallace F. Fenn, 2d vice-president, Hartford; George W. Eames, 3d vice-president, Bridgeport; Philip Bond, treasurer, New Haven; Charles Marcy Robinson, secretary, New Haven.

Connecticut Road Officials Association, Alfred H. Terry, president, Bridgeport; R. J. Ross, Secretary-treasurer, Hartford; W. E. Kennedy, vice-president, Waterbury.

Fairfield County: Redding Protective League, Dan Beard, chairman, Redding; Charles H. Plump, secretary, Redding; J. B. Sanford, treasurer, Redding.

New Haven County: Waterbury Good Roads Association, George Tracy, president, Waterbury; W. B. Reynolds, secretary, Waterbury; F. C. Peabody, treasurer, Waterbury.

Georgia

Atlantic & Gulf Highway Association, Dr. G. P. Folks, president, Waycross; C. Fort Andrews, secretary, Waycross.

Battlefield Route Association, George A. Veach, president, Adams Park; W. H. Field, secretary, Cartersville.

Central Route Association, Capt. H. H. Tift, president, Tifton.

Georgia-Alabama Good Roads Association, F. C. Lumpkin, president, Columbus.

Georgia Federation of Road Authorities, Wm. F. Eve, president, Augusta.

Georgia Good Roads Club, Fred. L. White, president, Buckhead.

North Georgia Good Roads Association, A. N. Tumlin, president, Cave Springs.

South Georgia Good Roads Association, L. V. Williams, president, Waycross; C. F. Andrews, secretary, Waycross.

Georgia Carolina Good Roads Association, E. J. Watson, president, Columbia, S. C.

Columbus, Harris County & Pine Mountain Good Roads Association, Frank G. Lumpkin, chairman, Columbus; Willis B. Powell, secretary, Columbus.

Appling County Good Roads Association, W. H. Tilman, president, Surrency.

Ben Hill County Good Roads Club, J. G. Knapp, president, Fitzgerald.

Berrien County Good Roads Association, Danl. McCraney, president, Sparks.

Brooks County Highway Improvement Association, H. W. Stubbs, president, Quitman.

Butts County Good Roads Association, S. J. Smith, president, Jackson.

Charlton County Good Roads Association, P. T. Osterman, president, St. George.

Clarke County Good Roads Association, Martin J. Abney, president, Athens.

Clinch County Good Roads Association, J. T. Dame, president, Homerville.

Crawford County Good Roads Association, S. H. Phelan, president, Roberta.

Crisp County Good Roads Association, Dr. T. J. McArthur, president, Cordele.

Dodge County Good Roads Association, Sol Herrman, president, Eastman.

Dooly County Good Roads Association, J. O. Heard, president, Vienna.

Douglas County Good Roads Association, A. S. Gresham, president, Douglasville.

Elbert County Good Roads Association, L. M. Brown, president, R. F. D. 3, Elberton.

Fayette County Good Roads Association, A. O. Bloblock, president, Fayetteville.

Glascock County Good Roads Association, Albert Logue, president, Gibson.

Glynn County Good Roads Association, Albert Fendig, president, Brunswick.

Grady County Good Roads Association, W. B. Roddenberg, president, Cairo.

Greene County Good Roads Club, W. P. McWhorter, president, Woodville.

Habersham County Good Roads Association, John Martin, president, Clarkesville; W. S. Irwin, secretary, Clarkesville.

Hall County Good Roads Association, J. M. Mundy, president, Gainesville.

Hart County Good Roads Association, L. S. Brown, president, Hartwell.

Houston County Good Roads Association, J. L. Fincher, president, Ft. Valley.

Jeff Davis County Good Roads Association, N. L. Hatten, Hazelhurst.

Jefferson County Good Roads Association, W. J. Wrens, president, Wrens.

Jackson County Good Roads Association, W. C. Davis, president, Commerce.

Liberty County Good Roads Association, Dr. D. W. Baggs, president, Ludowici.

Meriweather County Good Roads Association, J. M. Barnes, president, Bullochville.

Monroe County Good Roads Association, Col. J. O. Persons, president, Forsyth.

Newton County Good Roads Club, L. W. Jarman, president, Porterdale; J. H. Echols, secretary, Covington.

Ninth Ward and West DeKalb Good Roads Improvement Club, A. S. Hock, president, Kirkwood.

Pierce County Good Roads Association, L. W. Root, president, Blackshear,

Piedmont Highway Association, Wm. Eberhart, president, Cornelia.

Pike County Good Roads Association, W. A. Strickland, president, Concord.

Pulaski County Good Roads Association, T. D. Walker, president, Cochran.

Rabun County Good Roads Association, A. J. Duncan, president, Clayton.

Richmond County Good Roads Association, D. C. Haynes, president, Augusta.

Spalding County Good Roads Association, Hon. Roswell H. Drake, president, Griffin.

Taylor County Good Roads Association, W. D. Steed, president, Butler.

Telfair County Good Roads Association, Capt. T. J. Smith, president, McRae.

Tift County Good Roads Association, Capt. H. H. Tift, president, Tifton; W. E. Farmer, secretary, Tifton.

Turner County Good Roads Association J. S. Shingler, president, Ashburn,

Upson County Good Roads Association, O. B. Clements, president, Yatesville.

Ware County Good Roads Association, Dr. G. P. Folks, president, Waycross.

Washington County Good Roads Association, C. H. Shephard, president, Tennille.

Wayne County Good Roads Association, W. J. Broadhurst, president, Jesup.

Illinois

Illinois Bankers Association, S. E. Bradt, chairman, DeKalb.

Illinois Commercial Federation, C. A. Kiler, chairman, Champaign.

Illinois Official Trans-Continental Route Association, Geo. E. Stocking, president, Rochelle; S. F. Durga, secretary, DeKalb.

Illinois Highway Improvement Association, Wm. G. Edens, president, Central Trust Co., Chicago; R. J. Finnegan, secretary, 15 South Market St., Chicago.

Bureau County Road Improvement Association, C. O. Brigham, president, Princeton; K. B. Seibel, secretary, Princeton.

Clark County: Casey Good Roads Club, W. M. Abraham, secretary, Casey.

Cumberland County National Road Association, P. J. Bowman, president, Greenup; E. M. Eckard, secretary, Greenup.

DeKalb County: Waterman Coöperative Good Roads League, Dr. C. H. Wilkenson, president, Waterman; W. T. Wiltberger, secretary, Waterman.

Effingham County Good Roads Association, A. D. McCallen, president, Effingham.

Effingham Good Roads Club, J. H. Curry, secretary, Effingham.

Henry County: Galva Good Roads Improvement Association, John Miller, chairman, Galva.

Jo Daviess County: Progressive Good Roads Club, Dr. D. G. Smith, president, Elizabeth; C. A. Walters, secretary, Elizabeth.

Macoupin County: Betsey Ann Association Inc., H. A. Heidemann, president, Brighton; Irvin M. Clark, secretary, Brighton.

Randolph County Good Roads Association, L. H. Paulter, Evansville.

Rock Island County: Black Hawk Good Roads Association, D. W. Matthews, president, Milan.

Rock Island County: Highway Improvement Association, E. W. Woodcock, secretary, Moline.

St. Clair County: Good Roads Coöperative League, G. G. Bock, president, Smithton.

Washington County Good Roads Association, W. O. Weihe, president, Nashville.

Indiana

Good Roads Association, T. L. Wheeler, secretary, Huntington.
Indiana Association of County Commissioners & County Attorneys, Indianapolis.
Indiana Federated Commercial Clubs, Good Roads Committee, L. H. Lewis, secretary, Indianapolis.
Indiana Good Roads Association, C. A. Kenyon, president, Claypool Building, Indianapolis.
Indiana Letter Carriers' Association, Good Roads Committee, W. J. Ward, chairman, Carmel.
Northern Indiana Good Roads Association, Aaron Jones, president, South Bend; C. E. Craybill, secretary, South Bend.
Clark County: Fayette Township Good Roads Association, John Loesch, secretary, Floyd Knobs.
Hendricks County: Plainfield Improvement League, Dr. Amos Carter, president, Plainfield.
Jefferson County Good Roads Association, John McGregor, president, Madison.

Iowa

Ayr Line Association, Albert I. Smith, president, Mount Ayr; H. C. Beard, secretary, Mount Ayr,
Blue Grass Road, Joe L. Long, president, Des Moines.
Cannon Ball Trail, James F. Harvey, Leon.
Corn Belt Highway, F. L. Hall, Secretary, Weldon.
Council Bluffs, Sioux City & Spirit Lake Highway Association, Frank Patch, president, Hartley.
Des Moines-Fort Dodge & Spirit Lake Highway Association, J. F. Ford, secretary, Fort Dodge.
Des Moines Thresher Club, W. L. Trueblood, president, Des Moines.
"Great White Way", Toy A. Stacy, secretary, Adair.
Hawkeye Highway, Dr. H. M. Bradley, secretary, Manchester.
Inter-State Trail Association, W. A. Hopkins, Lamoni.
I-O-A Short Line, Chas. F. Walling, president, Oskaloosa.
Iowa Good Roads Association, Lafayette Young, Sr., president, Des Moines; Thos. H. MacDonald, secretary, Ames.
Iowa Official Transcontinental Route (Lincoln Memorial Highway), W. F. Haskell, president, Cedar Rapids; W. C. Rollins, secretary, Denison.
Iowa State Quarrymen's Association, James W. Burroughs, secretary, Marshalltown.
North Iowa Pike Association, Wm. Hathorn, secretary, Mason City.
River-to-River Road Association, Bert N. Mills, secretary, Des Moines.
Waubonsie Trail, U. G. Reininger, president, Sioux Falls, S. D.
Adams County: Prescott Community Improvement Club, H. M. Stanley, secretary, Prescott.
Black Hawk County Good Roads Club, F. A. Ferguson, president, Waterloo.
Buena Vista County: Storm Lake-Okobogi Air Line, Scott Bradford, president, Storm Lake.
Lee County: Fort Madison First Association, S. Atlee, president, Ft. Madison; J. R. Frailey, secretary, Ft. Madison.
Lucas County: Russell Boulevard Association, Algmer J. Allen, president, Russell.

Kansas

Kansas State Good Roads Association, Arthur Capper, president, Topeka; G. J. Hinshaw, secretary, Newton.
Kansas Engineering Society, J. M. Meade, president, Topeka; T. J. Strickler, secretary-treasurer, Topeka.

Meridian Road Association, John C. Nicholson, secretary-treasurer, Newton.

Kansas Division, W. W. Watson, president, Salina; S. E. Jackman, secretary, Minneapolis.

Old Santa Fe Trail, T. W. Whiting, president, Council Grove; Frank A. Davis, secretary, Herington.

Golden Belt Road Association, C. M. Harger, president, Abilene; W. H. Rhodes, secretary, Manhattan.

Sunflower Trail, R. M. Anderson, president, Beloit; Frank A. Lutz, secretary, Beloit.

Oil Belt Route, H. W. Loy, president, Chanute; Herbert Cavaness, secretary Chanute.

Tri-State Trail, H. O. Douglass, president, Oberlin; Chas. Sawyer, secretary-treasurer, Norton.

The New Santa Fe Trail, R. H. Faxon, president, Garden City; C. H. Scott, secretary-treasurer, Hutchinson.

Rock Island Highway, C. W. Cole, president, Newton; A. Q. Miller, secretary-treasurer, Belleville.

Atchison County Good Roads Association, A. S. Drury, president, Atchison; Alva Clapp, secretary, Atchison.

Cloud County Good Roads Association, P. G. Harmon, secretary-treasurer, Concordia.

Geary County Good Roads Association, Dr. W. S. Yates, president, Junction City; O. E. Hutchings, secretary-treasurer, Junction City.

Graham County Good Roads Association, William Burns, president, Bogue; D. C. Green, secretary, Hill City.

Montgomery County Good Roads Association, H. G. James, president, Independence; Sam L. McMurtry, secretary, Independence.

Cherryvale Good Roads Association, H. M. Casebeer, president, Cherryvale; F. D. Moffett, secretary-treasurer, Cherryvale.

Nemaha County: Goff Improvement Association, Chas. A. Richard, president, Goff; E. E. Holstone, secretary, Goff.

Shawnee County Good Roads Association, A. E. McGregor, president, Washington.

Linn Good Roads Association, Henry Meichard, secretary-treasurer, Linn.

Kentucky

Kentucky Good Roads Association, R. J. McBride, president, Louisville Times, Louisville; R. C. Terrell, secretary, Frankfort.

Kentucky County Road Engineers Association, J. X. Russell Gaines, president, Court House, Louisville; chairman executive committee: R. C. Terrell, Frankfort; J. G. Baxter, secretary, Richmond; J. F. Grimes, secretary, executive committee, Frankfort.

Southern Kentucky Good Roads Association, N. R. Patterson, president, Pineville; Miss Lena Rollins, secretary, Pineville, George H. Reese, treasurer, Pineville.

Breckenridge County Good Roads Association, W. J. Piggott, president, Irvington, Mrs. R. B. McGlothlan, secretary, Irvington.

Crittenden County: Good Roads Committee, Carl Henderson, president, Marion; G. T. Belt, secretary, Sheridan.

Henry County Citizens League, Park C. Smith, president, Smithfield; E. A. Gullion, secretary, New Castle.

Hopkins County Road Association, J. F. Gordon, president, Madisonville; G. W. Sypert, secretary, Madisonville.

Kenton County Good Roads Association, W. L. White, secretary, R.F.D. 1, Latonia.

Knox County: Boone Way Booster Band, J. T. Stamper, president, Barbourville; W. H. McDonald, secretary.

Larue County: Central Lincoln Road Club, Dr. J. C. Jones, president, Buffalo; W. G. Dezarn, secretary-treasurer, Hodgenville.

McCracken County: Joint Committee of Board of Trade, Retail Merchants Association, and Automobile Club, B. Weille, chairman, Paducah.

Paducah Road Association, C. W. Craig, president, Paducah; Ben Wrillie, secretary, Paducah.

Glade District Good Roads Association, John L. Gay, president, Berea.

Nelson County: Good Roads Association (Bloomfield,) Guthrie Wilson, secretary, Bardstown.

Rockcastle County: Boone Way Booster Band, W. H. Fish, president, Mt. Vernon; James Maret, secretary-treasurer, Mt. Vernon.

Rowan County Good Roads Association, S. M. Bradley, president, Morehead; B. S. Wilson, secretary, Morehead; H. H. Caudill, treasurer, Morehead.

Todd County Good Roads Association, George Snadon, chairman, Guthrie; George Weathers, secretary, Elkton.

Warren County Good Roads Association, Dr. Jos. N. McCormack, president, Bowling Green.

Whitley County Good Roads Organization, S. Stanfill, chairman, Williamsburg; H. C. Gillis, secretary.

Louisiana

Baton Rouge-New Orleans Good Roads Association, F. B. McQuesty, secretary, Baton Rouge.

Acadia Parish Good Roads Association, H. E. Lewis, president, Crowley.

Calcasieu Parish Good Roads Association, Dr. J. M. Ways, president, Kinder.

Iberia Parish Good Roads Association, Dr. Guy Shaw, president, Loreauville.

Ouachita Parish: East Side Road Committee, Victor C. Barringer, secretary, Monroe.

St. Landry Parish Good Roads Association, Jas. O. Chachere, president, Opelousas.

Maine

Aroostook County Good Roads Association, Howard W. Safford, president, Mars Hill; Michael M. Clarke, secretary, Houlton.

Knox County Automobile & Good Roads Association, A. S. Littlefield, president, Rockland.

Piscataquis County Good Roads Association, E. E. Whitney, president, Dover; C. E. Kimball, secretary-treasurer, Dover.

Kennebunk Good Roads Association, Dr. Frank M. Ross, president, Kennebunk; Frank W. Bonser, secretary.

Maryland

Baltimore County Good Roads Association, J. Frank Shipley, president, Gwynbrook; D. Frank Shamberger, secretary, 1507 McCulloh St., Baltimore.

Baltimore Engineers' Club, J. H. Milburn, c/o B. & O. R. R. Co., president; Baltimore, H. C. Williar, secretary, c/o Paving Commission, Baltimore.

Arlington Improvement Association, Chas. T. Cockey, Jr., president, Arlington.

Belair Road Improvement & Protective Association, Dr. A. L. Wilkinson, president, Raspeburg.

Central Park Improvement Association, R. H. Williams, president, 619 Gaither building, Baltimore.

Catonsville Neighborhood Improvement Association, John Hubner, president, Catonsville.

East Arlington Improvement Association, Chas. Goldeisen, president, Arlington.

Govans Improvement Association, Dr. E. M. Duncan, president, Govans.

Good Roads Association, Major John I. Yellott, president, Towson.

Green Spring Park & Pimlico Road Improvement Association, Wm. G. Henkel, president, 1021 Light Street, Baltimore.

Halethorpe Protective & Improvement Association, Dr. Fred V. Beitler, president, Halethorpe.

Hamilton Improvement Association, William McCallister, president, Hamilton.

Hayward Improvement Association, W. O. Smith, president, Arlington.

Hebbville Improvement Association, Wm. F. Piel, Jr., president, Hebbville.

Hereford Improvement Association, Dr. Fred G. Mitchell, president, Glencoe.

Hillsdale Improvement Association, E. S. Hutton, president, Hillsdale.

Howard Park Improvement Association, Louis Moller, president, 111 Light St., Baltimore.

Lansdowne Improvement Association, J. D. W. Lindquist, president, Lansdowne.

Lauraville Improvement Association, Frederick Evans, president, Lauraville.

Lutherville Improvement Association, J. Robert Wood, president, Lutherville.

Marble Hill Improvement Association, George Jessup, president, Cockeysville.

Mt. Washington Improvement Association, Frank J. LaMotte, president, Mt. Washington.

Orangeville Improvement Association, M. P. Ebaugh, president, Orangeville.

Park Heights Pimlico and Arlington Improvement Association, John Trainor, president, 877 N. Howard St., Baltimore.

Parkville Improvement Association, Thomas F. Mallonee, president, Parkville.

Pikesville Improvement Association, W. E. Lovering, president, Pikesville.

Relay Improvement Association, J. A. Baldwin, president, Relay.

Roland Park Civic League, Dr. Paul Haupt, president, Roland Park.

Towson Improvement Association, John I. Yellott, president, Towson.

Upper Falls Improvement Association, Edward Reynolds, president, Upper Falls.

Windsor Hills Improvement Association, Rev. W. A. Crawford Frost, president, Windsor Hills.

Chase Improvement Association, H. E. Brasier, president, Chase.

Neighborhood Association of Highlandtown and Canton, Townley R. Wolfe, president, 3518 Bank St., Baltimore.

Rockdale Improvement Association, H. E. Hough, president, Raspeburg.

St. Helena Improvement Association, Harry Marchant, president, St. Helena.

Woodlawn Improvement Association, G. L. Ellis, president, 316 W. Mulberry St., Baltimore.

Cecil County Farmers' Civic and Business Association, W. R. Cameron, president, Rising Sun; Mr. Briggs, secretary, North East.

East New Market Improvement Association, Chas. Webster, president, East New Market; W. A. Percy, secretary, Vienna.

Massachusetts

Massachusetts Highway Association, James H. Sullivan, president, Boston; John M. McCarthy, secretary, 15 Ashburton Place, Boston.

Essex County Associated Boards of Trade, Committee on Highways, John F. Browning, chairman, 418 Lafayette St., Salem.

Hampden County Improvement League, Horace A. Moses, president, Russell; John A. Scheuerle, general secretary, Massasoit Building, Springfield.

Michigan

Michigan Good Roads Association, P. T. Colgrove, president, Hastings; A. A. Anderson, secretary, Hastings.

Northeastern Michigan Development Bureau, Vet S. Maloney, president, Cheboygan; T. F. Marston, secretary-manager, Bay City.

Western Michigan Development Bureau, D. H. Day, president, Glen Haven; John I. Gibson, secretary, Traverse City.

Lake Huron Shore Good Roads Association, J. R. Snody, president, Onaway; John Simmons, secretary, Alpena; road commissioner, H. K. Gustin, Alpena.

West Michigan Pike Association, Dr. Wm. DeKleine, president, Grand Haven; Richard M. Hoffman, secretary-treasurer, Manistee.

Western Michigan Lakeshore Highway Asociation, Lee H. Trott, president, Muskegon; William De Kleine, secretary, Grand Haven.

Trunk Highway Association, W. F. Johnson, secretary, Roscommon.

Berrien County Good Roads Association, J. M. Ball, president, St. Joseph; I. W. Allen, secretary, St. Joseph.

Montcalm County: Stanton Good Roads Association, M. W. Stevenson, president, Stanton; D. A. Towle, secretary, Stanton.

Sheridan Good Roads Association, C. H. Clement, president, Sheridan; A. E. Stebbins, secretary, Stebbins.

Wexford County Good Roads Association, D. B. Kelley, president, Cadillac; Henry Knowlton, secretary, Cadillac.

Minnesota

Minnesota Road Makers' Association, John H. Mullen, secretary, St. Paul.

State Highway Association, Geo. W. Cooley, secretary, St. Paul.

Aitkin County: Aitkin Development Association, Mr. Warner, president, Aitkin.

Brown County: Springfield Good Roads and Development Association, Springfield.

Carlton County Development Association, Carlton.

Crow Wing County: Northern Development Association, C. A. Albright, president, Crow Wing.

Hennepin County: Minneapolis Civic and Commerce Association, Douglas A. Fiske, president, Minneapolis; Howard Strong, secretary, Minneapolis.

LeSuer County: Elysian Good Roads Association, C. Gologan, president, Elysian.

LeSuer Good Roads Association, Oscar Swenson, president, Le Suer.

New Prague Good Roads Association, J. F. Wraybeck, secretary, New Prague.

Nicollet County Good Roads Association, A. J. Potts, president, Nicollet.

Rice County: Lonsdale Good Roads Association, A. J. Smisek, president, Lonsdale.

Scott County Good Roads Association, J. H. Moore, president, Jordon; J. G. Casey, secretary, Jordan.
Steele County: Good Roads Association, Fred Jurgenson, secretary, Blooming Prairie.
Waseka County: Janesville Good Roads Association, Mr. Bardon, president Janesville.
New Richland Good Roads Association, M. A. Hodgkins, president, New Richland.
Waseka Good Roads Association, Dr. Blanchard, president, Waseka.

Mississippi

State Highway Association, C. C. Dunn, president, Corinth; M. L. Bipler, secretary, Biloxi.
Adams County Good Roads Committee, P. W. Mulverhill, secretary, Natchez.
Alcorn County: Good Roads Association, R. L. Young, president, Corinth; W. D. Striplin, secretary, Corinth.
Chickasaw County Good Roads Committee, J. S. Rowe, chairman, Okolona; F. M. Elliott, secretary, Okolona.
Coahoma County: Good Roads Association, H. H. Hopson, chairman, Clarksdale; F. G. Wingfield, secretary, Clarksdale.
Forest County Good Roads Commission, J. K. Denham, chairman, Hattiesburg.
Harrison County Road Association, J. H. Long, president, Pass Christian; M. P. Bouslog, secretary, Gulfport.
Harrison County: Good Roads Committee, G. W. Grayson, president, Biloxi; S. M. Tracy, secretary, Biloxi.
Hinds County: Executive Committee, East and West Highway Association, Edgar S. Wilson, chairman, Jackson.
Lauderdale County Road Association, W. P. Moore, Engineer, Meridian.
Lincoln County Highway Commission, H. Cassidy, president, Brookhaven; Estus Smith, secretary, Brookhaven.
Marshall County Road Committee, W. B. Bradberry, president, Holly Springs; John E. Anderson, secretary, Holly Springs.
Montgomery County Road Commission, Henry Hart, chairman, Winona.
Newton County: Good Roads League, W. V. Fant, president, Newton,
Warren County Road Association, J. W. Tucker, president, Vicksburg; J. H. Adams, secretary, Vicksburg.
Yazoo County Road Association, E. L. Tarry, secretary, Yazoo City.

Missouri

Cannon Ball Trail Association, Jas. R. Bowsher, president, Leon; Chas. D. Davis, secretary, Princeton.
Capitol Route State Highway Association, J. H. Bothwell, president, Sedalia; M. V. Carroll, secretary, Sedalia.
Highway Engineer's Association of Missouri, L. M. Stallard, president, St. Joseph; J. F. Warner, secretary, Benton.
Missouri Association of County Judges, G. W. Pine, president, Palmyra; Curtis Hill, secretary, Columbia.
Missouri Highway Association, Ray F. Britton, president, St. Louis; J. B. Grigg, secretary, Joplin.
North Missouri Cross State Highway Association, George Robertson, president, Mexico; John F. Morton, secretary, Richmond.
Missouri Good Roads Association, E. E. E. McJimsey, president, Springfield; M. V. Carroll, secretary, Sedalia.

Old Trails Road Association, Walter Williams, president, Columbia; E. A. Mitchell, secretary, Marshall.

Sedalia-Springfield Highway Association, W. S. Jackson, president, Warsaw; M. V. Carroll, secretary, Sedalia.

Short Line Route Association, M. H. Hall, president, Tarkio; F. S. Braveis, secretary, Tarkio.

St. Joe-Des Moines Interstate Trail Association, W. A. Hopkins, president, Lamoni; Dan'l Anderson, secretary, Lamoni, Ia.

St. Joe-Des Moines Ayr Line Association, A. I. Smith, president, Mt. Ayr; H. C. Beard, secretary, Mt. Ayr, Ia.

The Brotherhood of Good Road Draggers. G. W. Batterson, president, Sturgeon; Omar D. Gray, secretary, Sturgeon.

Barry County Good Roads Association, J. F. Normond, president, Monett; Bert Robbins, Secretary, Cassville.

Barton County Good Roads Association, W. J. Evilsizer, president, Lamar; James Graham, secretary-treasurer, Lamar.

Cass County: Westline Good Roads Association, G. W. Stark, secretary, Westline.

Daviess County Good Roads Association, George A. Iddings, president, R.F.D. 4, Pattonsburgh; Harvey B. Miller, secretary, Gallatin.

Franklin County Good Roads Association of St. Clair, C. E. Briegleb, president, St. Clair; Dr. W. E. Kitchell, secretary, St. Clair.

Howard County: Chariton Township Good Roads Association, Owen Harrison, president, Glasgow; E. W. Price, Secretary, Glasgow.

Jasper County 365 Day Road Club, J. D. Clarkson, president, Carthage; Chas. A. Blair, secretary, Carthage.

Perry County Good Roads Association, Robert H. Hudson, president, St. Marys; J. F. DeLassus, secretary, Crosstown.

St. Louis County Highway and Waterway Association, Gottlieb Bayer, president; Chesterfield, Fred Mueller, secretary, Clayton.

St. Louis County Olivette-Stratman Improvement Association, M. B. Greensfelder. president, Clayton; H. H. Elbring, secretary, Clayton.

Vernon County: Nevada Good Roads Club, R. A. Buckner, president, Nevada; J. M. Clack, secretary, Nevada.

Montana

Montana Good Roads Congress, Mr. Brown, president, Great Falls; P. N. Bernard, secretary, Kalispell,

Committee on State Road Project, Montana Society of Engineers, Clinton H. Moore, secretary, Butte.

Cascade County Good Roads Association, A. R. Wheeler, president, Great Falls; Walter S. Clark, secretary, Great Falls.

Lewis and Clarke County: Helena Good Roads Association, Lewis Penwell, president, Helena; A. C. Johnson, secretary, Helena.

Sweet Grass County Good Roads Association, Harvey Coit, president, Big Timber; Dorman Kellogg, secretary, Big Timber.

Nebraska

Meridian Road Association, Charles Baugh, York, secretary.

Boone County Good Roads Association, D. J. Poynter, secretary, Albion.

Brown County: Ainsworth Branch of Trans-Continental Route to Pacific Coast, John B. Stoll, secretary, Ainsworth.

Johnstown Div. of Trans-Continental Route to Pacific Coast, Ed. Bolhe, Johnstown.

Long Pine Div. of Trans-Continental Route to Pacific Coast, W. A. Bucklin, secretary, Long pine.

Cass County Good Roads Association, C. E. Tefft, secretary, Weeping Water.

Cherry County: Wood Lake Good Roads Association, W. F. Parker, secretary, Wood Lake.

Colfax County Good Roads Association, J. E. McNabb, secretary, Schuyler.

Dawes County: Chadron Good Roads Association, W. S. Gillam, secretary, Chadron.

Dodge County Good Roads Association, George F. Staats, secretary, Fremont.

Douglas County Good Roads Association, W. J. Kirkland, secretary, Omaha.

Hall County: Grand Island Good Roads Club, A. M. Connors, secretary, Grand Island.

Howard County Good Roads Association, A. L. Baliman, secretary, St. Paul.

Lancaster County Good Roads Association, Fred C. Fiske, secretary, Lincoln.

Madison County Good Roads Association, C. B. Dalter, secretary, Madison.

Nance County Good Roads Association, J. D. Barnes, secretary, Fullerton.

Scotts Bluff County Auto and Good Roads Association, C. A. Morrill, secretary, Scotts Bluff.

Washington County: Arlington Auto and Good Roads Association, R. A. Davies, secretary, Arlington.

New Jersey

New Jersey Association of County Engineers, Joshua Doughty, Jr., president, Somerville; E. E. Reed, secretary, Trenton.

New Mexico

New Mexico Good Roads Association, Ralph E. Twitchell, president, Albuquerque; E. L. Grose, secretary.

Northern New Mexico Good Roads Association, L. S. Wilson, president, Raton; F. E. Van Dusen, secretary.

State Association of Highway Officials, Francis E. Lester, president, Mesilla Park; Harvey M. Shields, secretary, Raton.

Dona Ana County: Dona Ana County Good Roads Association, W. A. Sutherland, chairman, Las Cruces.

Lincoln County Good Roads Association, J. W. Laws, chairman, Lincoln.

New York

New York State Road Builders Association, S. B. Van Wagenen, president, Rondout; John J. Ryan, secretary, 25 N. Pearl St., Albany.

North Carolina

Central Highway Committee, H. B. Varner, chairman, Lexington.

Charlotte-Wilmington Highway Association, A. D. Skelding, secretary, Charlotte.

North Carolina Good Roads Association, Joseph Hyde Pratt, secretary, Chapel Hill.

Anson County Good Roads Association, Dr. W. J. McLendon, president, Wadesboro; T. V. Howell, secretary-treasurer, Peachland.

Ashe County Good Roads Association, P. E. Fogle, president, Beaver Creek; W. E. Johnson, secretary, Beaver Creek.

Beaufort County Good Roads Association, George T. Leach, president, Washington; C. L. Morton, secretary-treasurer, Washington.

Bladen County Good Roads Association, O. L. Clark, president, Clarkton; W. J. Davis, secretary, Elizabethtown.

Asheville and Buncombe County Good Roads Association, E. C. Chambers, president, Asheville; B. M. Jones, secretary-treasurer, Asheville.

Burke County: Bridgewater Township Good Roads Association, W. Lyerly, president, Bridgewater; R. A. Abernathy, secretary-treasurer, Bridgewater.

Burke County Good Roads Association, J. E. Erwin, president, Morganton.

Connelly Springs Township Good Roads Association, Allis Coulter, president, Connelly Springs; J. L. Sides, secretary-treasurer, Connelly Springs.

Glen Alpine Township Good Roads Association, Dr. E. A. Hennessee, president, Glen Alpine; J. H. Giles, secretary-treasurer, Glen Alpine.

Hildebran Township Good Roads Association, J. W. Beach, president, Hildebran; A. L. Yoder, secretary-treasurer, Hildebran.

Caldwell County: Little River Township Good Roads Association, J. F. Steele, president, Lenoir, R.F.D. 2; F. M. Whitner, secretary, Lenoir, R.F.D. 2.

Camden County Good Roads Association, P. W. Stevens, president, Shiloh; E. I. Sawyer, secretary-treasurer, Camden.

Caswell County Good Roads Association, B. S. Graves, president, Yanceyville; J. W. James, secretary-treasurer, R. F. D. 1, Leasburg.

Carteret County Good Roads Association, C. S. Wallace, president, Morehead City; M. L. Willis, secretary-treasurer, Morehead City.

Catawba County Good Roads Association, R. L. Shuford, president, Newton, R. F. D. 1; R. P. Caldwell, secretary, Newton.

Chatham County Good Roads Association, James B. Atwater, president, Bynum; Frank D. Jones, secretary-treasurer, Gulf.

Chowan County Good Roads Association, J. H. McMullan, Jr., president, Edenton; H. L. Story, secretary-treasurer, Edenton.

Columbus County Good Roads Association, C. Herbert Smith, president, Acme, R. F. D.; K. Clye Council, secretary, Wananish.

Craven County Good Roads Association, R. A. Nunn, New Bern; W. G. Boyd, secretary, New Bern.

Cumberland County Good Roads Association, T. G. McAlister, president, Fayetteville; W. M. Walker, secretary-treasurer, Fayetteville.

Currituck County Good Roads Association, E. R. Johnson, secretary-treasurer, Currituck.

Davidson County: Abbots Creek Good Roads and Agricultural Association, C. D. Motsinger, president, Winston-Salem, R. F. D. 5; C. H. Teague, secretary, Wallburg.

Arcadia Good Roads and Agricultural Association, J. E. Hill, president, Lexington, F. R. D. 4; C. A. Kimel, secretary, Clemmons, R. F. D. 2.

Alleghany Good Roads and Agricultural Association, Robert Stokes, president, Newson; J. L. Doby, secretary, Newson.

Boone Good Roads and Agricultural Association, W. B. Meares, Linwood.

Cotton Grove Good Roads and Agricultural Association, J. D. Lockabill, president, Southmont; John L. Miller, secretary, Linwood, R. F. D. 2.

Denton Good Roads and Agricultural Association, Rev. Jefferson Lanning, president, Denton; J. M. Daniel, secretary, Denton.

Cid Good Roads and Agricultural Association, N. H. Prevo, president, Cid; D. A. Leach, Secretary, Denton.

Hampton Good Roads and Agricultural Association, John W. Hampton, president, Clemmons, R. F. D. 2; J. L. Nelson, secretary, Clemmons, R. F. D. 2.

Healing Springs Good Roads and Agricultural Association, James I. Smith, president, Silver Hill, R. F. D. 1; Hurley Daniel, Secretary, Denton, R. F. D. 1.

Holly Grove Good Roads and Agricultural Association, C. A. Swink, president, Lexington, R. F. D. 2; James F. Deal, secretary-treasurer, Lexington, R. F. D. 2.

Jackson Hill Good Roads and Agricultural Association, Stokes Smith, president, Newson; C. L. Bedgett, secretary, Jackson Hill.

Liberty Good Roads and Agricultural Association, T. G. Kindley, president, Lexington; John W. May, secretary, Hannersville.

Midway Good Roads and Agricultural Association, G. Frank Lindsay, president, Wallburg, R. F. D. 1; P. E. Whicker, secretary, Winston-Salem.

Reedy Creek Good Roads and Agricultural Association, P. E Fritts, President, Lexington; R. F. D. 4; J. A. Hendricks, secretary, Lexington, R. F. D. 4.

Silver Hill Good Roads and Agricultural Association, Joe Hedrick, president, Silver Hill; Grover C. Palmer, secretary, Silver Hill.

Thomasville Good Roads and Agricultural Association, S. H. Averett, president, Thomasville; L. E. Bird, secretary, Thomasville.

Tyro Good Roads and Agricultural Association, N. H. Swicegood, president, Lexington, R. F. D. 5; Charles F. Koontz, secretary, Linwood, R. F. D. 1.

Davidson-Randolph Highway Association, Arthur Ross, president, Asheboro; G. Dan Morgan, secretary-treasurer, Denton.

Davie County Good Roads Association, T. J. Byerly, president, Mocksville; E. D. Williams, secretary, Mocksville; C. F. Stroud, secretary, Mocksville.

Duplin County Good Roads Association, Island Creek, Island Creek Township; George R. Ward, president, Wallace; W. B. Brice, secretary-treasurer, Wallace.

Durham County Good Roads Association, Dr. A. Cheatham, president, Durham; P. C. Graham, secretary-treasurer, Durham.

Edgecombe County Good Roads Association, B. F. Shelton, president, Tarboro.

Forsyth County Good Roads Association, Judge H. R. Starbuck, president, Winston-Salem; A. F. Yarborough, vice-president, Winston-Salem.

Gates County Good Roads Association, Lycurgus Hofler, president, Gatesville; S. P. Cross, secretary-treasurer, Gatesville.

Greene County Good Roads Association, E. D. Little, president, Snow Hill, R. F. D. 6; J. E. Debman, secretary-treasurer, Snow Hill.

Guilford County Good Roads Association, J. Van Lindley, president, Greensboro; S. L. Trogden, secretary-treasurer, Greensboro.

Halifax County Good Roads Association, John L. Patterson, president, Roanoke Rapids; Charles J. Shields, secretary-treasurer, Scotland Neck.

Harnett County Good Roads Association, Dr. J. W. Halford, chairman, Chalybeate Springs; C. D. McNeely, secretary, Chalybeate Springs.

Haywood County Good Roads Association, F. W. Miller, president Waynesville; James Atkins, secretary, Waynesville.

Hertford County Good Roads Association, A. C. Vann, president, Ahoskie, W. A. Thomas, secretary, Cofield.

Johnston County Good Roads Association, W. M. Sanders, president, Smithfield; C. M. Wilson, secretary-treasurer, Wilson's Mills.

Benson Township Good Roads Association, P. B. Johnson, president, Benson; R. F. Smith, secretary-treasurer, Benson.

Jones County Good Roads Association, R. L. May, chairman, Trenton; John R. Barker, secretary-treasurer, Trenton.

Lee County Good Roads Association, J. B. Watson, president, Jonesboro; T. S. Cross, Secretary, Sanford.

Lenoir County Good Roads Association, Dr. J. M. Parrott, president Kinston; Rev. C. W. Howard, secretary-treasurer, Kinston.
Lincoln County G. R. Association, W. C. Kiser, president, Lincolnton; Tom. Cansler, secretary Lincolnton.
McDowell County: Old Fort Township Good Roads Association, Dr. F. H. Ihne, Graphiteville.
Macon County Good Roads Association, T. M. Green, president, Franklin.
Madison County Good Roads Association, Jasper Ebbs, president, Spring Creek; Dudley Chipley, secretary-treasurer, Marshall.
Hot Springs Township Good Roads Association, N. J. Lance, president, Hot Springs; S. W. Brown, secretary, Hot Springs.
Martin County Good Roads Association, W. C. Manning, president, Williamston; C. H. Godwin, secretary treasurer, Godwin.
Mecklenburg County Good Roads Association, F. M. Shannonhouse, secretary, Charlotte.
Mitchell County Good Roads Association, George K. Pritchard, chairman, Bakersville; W. C. Berry, secretary, Bakersville.
Montgomery County Good Roads Association, Frank Page, president, Biscoe; O. B. Deaton, secretary-treasurer, Troy.
Moore County Good Roads Association, Leonard Tufts, president, Pinehurst; J. R. McQueen, secretary-treasurer, Pinehurst.
Northampton County Good Roads Association, John E. Moore, president, Jackson; A. J. Connor, secretary-treasurer, Rich-Square.
Orange County Good Roads Association, Frank Nash, president, Hillsboro; secretary-treasurer, Hillsboro.
Pasquotank County Good Roads Association, W. J. Williams, president, Elizabeth City, R. F. D. 4; G. R. Little, secretary-treasurer, Elizabeth City.
Pender County Good Roads Association, George J. Moore, president, Atkinson; Laughlin McNeill, secretary-treasurer, Burgaw.
Perquimans County Good Roads Association, T. F. Winslow, president, Hertford; W. B. Hudson, secretary-treasurer, Hartford.
Person County Good Roads Association, W. E. Morton, president, Roxboro, R. F. D. 3; J. W. Noell, secretary, Roxboro.
Pitt County Good Roads Association, R. R. Cotten, president, Bruce; H. A. White, secretary-treasurer, Greenville.
Randolph County Good Roads Association, J. E. Williamson, president, Worthville; J. B. McCraig, secretary-treasurer, Asheboro.
Richmond County Good Roads Association, B. F. Reynolds, secretary-treasurer, Rockingham.
Robeson County Good Roads Association, A. E. White, secretary-treasurer Lumberton.
Rockingham County Good Roads Association, J. P. Richardson, president, Reidsville.
Rowan County Good Roads Association, P. B. Beard, president, Salisbury; J. H. Warburton, secretary, Salisbury.
Gold Hill Township Good Roads Association, J. W. Peeler, president, Rockwell.
Rutherford County Good Roads Association, Dr. John C. Twitty, president, Rutherfordton.
Stanley County Good Roads Association, J. M. Harris, Albemarle.
Stokes County Good Roads Association, John W. Kurfees, president, Germanton; Eugene Pepper, secretary, Danbury.
Surry County Good Roads Association, J. B. Sparger, president Mt. Airy; M. F. Butner, secretary-treasurer, Pinnacle.
Tyrrell County Good Roads Association, F. L. W. Cahoon, president, Columbia; H. S. Swain, secretary-treasurer, Jerry.

Union County Good Roads Association, W. C. Heath, president, Monroe; W. V. Love, secretary, Monroe.

Wake County Good Roads Association, Dr. J. M. Templeton, president, Cary; Col. Edward E. Brittain secretary-treasurer, Raleigh.

Washington County Good Roads Association, T. W. Blount, president, Roper; W. M. Bateman, secretary-treasurer, Plymouth.

Wayne County Good Roads Association, George C. Royall, president, Goldsboro; G. A. Norwood, secretary-treasurer, Goldsboro.

Wilkes County Good Roads Association, H. W. Horton, president, North Wilkesboro; Bruce Craven, secretary-treasurer, North Wilkesboro.

Yadkin County Good Roads Association, F. W. Hanes, chairman. Yadkinville; W. E. Rutledge, secretary, Yadkinville.

North Dakota

State Highway Improvement Association, Hon. L. B. Hanna, president, Bismarck; J. P. Hardy, secretary-treasurer, Fargo.

Ohio

Ohio Good Roads Federation, Jesse Taylor, president 515 Hartman Building› Columbus; A. H. Huston, secretary, 515 Hartman building, Columbus.

Franklin County Good Roads Association, E. A. Peters, president, Groveport; Wm. H. Maise, secretary, 406 Harrison Building, Columbus.

Greene County Good Roads Association, H. N. Ensign, president, Jamestown; R. S. Dean, secretary, R. F. D., Xenia.

Hamilton County Automobile Club, Dr. C. L. Bonefreeld, president, Gibson Home, Cincinnati; Dr. L. S. Colter, secretary, Gibson Home, Cincinnati.

Knox County Good Roads Association, H. C. Devine, president, Mt. Vernon; W. C. Rimer, secretary, Mt. Vernon.

Portage County Improvement Association, R. D. Hanna, president, Ravenna; C. R. Sharp, secretary, Ravenna.

Preble County Good Roads Association, C. W. Bloom, president, New Paris; C. G. Hawley, secretary, New Paris.

Scioto County Good Roads Association, L. Taylor, president, Rarden.

Wayne County Good Roads Association, Hon. Ed. S. Werts, president, Wooster.

Williams County Good Roads Association. Frank Dolph, president, West Unity; Hon. Wm. Behne, secretary, Bryan.

Oklahoma

Oklahoma State Good Roads Association, W. R. Goit, president; C. C. Hudson, secretary, Oklahoma City.

Oregon

Oregon Development League, Theo. B. Wilcox, president, Portland; C. C. Chapman, secretary, Portland; W. S. Worden, chairman, Good Roads Committee, Klamath Falls.

Oregon Association for Highway Improvement, James Cole, vice-president Board of Trade Building, Portland; Philip S. Bates, secretary, 215 Oregonian Building.

Baker County: Huntington Development League, W. J. Woods, president, Huntington; J. E. Paul, secretary, Huntington.

Sumpter District Development League, L. C. Edwards, president, Sumpter; H. E. Hendrix, secretary, Sumpter.

Clackamas County: Canby Development League, R. A. Coe, president, Canby; H. H. Eccles, secretary, Canby.

Oak Grove Improvement Association, H. Thiessen, president, Williamette; J. D. Butler, secretary, Williamette.

Clatsop County: Hammond Development League, Sam Hanson, president, Hammond; William Potter secretary, Hammond.

Seaside Civic Improvement Club, Geo. E. Shaver, president, Seaside; V. M. Spurgeon. secretary, Seaside.

Coos County Good Roads Association, A. T. Morrison. president, Coquille.

Culver Development League, Wm. Boegli, president, Culver; D. B. Troutt, secretary, Culver.

Hampton Valley Improvement Association, A. T. Frame, president, Rolyat; V. Schroder, secretary, Rolyat.

Laidlaw Development League, J. N. B. Gerking, president, Laidlaw; Fred N. Wallace, secretary, Laidlaw.

Curry County Development League, Geo. D. Wood, manager, Gold Beach.

Douglas County Good Roads Association, Henry Hart, president, Roseburg; Carl D. Shoemaker, secretary, Roseburg.

Riddle Development League, R. C. Cutsforth, Riddle; T. W. Johnson, secretary, Riddle.

Grant County: Canyon Citizen's League, F. S. Slater, president, Canyon City; Otis Patterson, secretary, Canyon City.

Rhode Island

League of Improvement Societies in Rhode Island, Edwin A. Noyes, president, East Greenwich; Luther D. Burlingame, 15 Catalpa Road, secretary, Providence.

South Carolina

South Carolina Good Roads Association, Fingal G. Black, president, Columbia; F. H. Hyatt, secretary, Columbia.

Abbeville County Good Roads Association, Dr. C. C. Gambrell, president, Abbeville.

Aiken County Good Roads Association, J. T. Shuler, president, Aiken.

Anderson County Good Roads Association, W. L. Brissey, president, Anderson.

Bamberg County Good Roads Association, S. G. Mayfield, president, Bamberg.

Barnwell County Good Roads Association, S. Z. Bryan, president, Allendale.

Calhoun County Good Roads Association, J. M. Moss, president, St. Matthew.

Charleston Automobile Club, J. M. Connelly, president, Charleston.

Cherokee County Good Roads Association, T. B. Butler, president, Gaffney.

Chester County Good Roads Association, John R. Alexander, president, Chester.

Dorchester County Good Roads Association, John A. Hiers, president, St. George.

Edgefield County Good Roads Association, S. B. Mays, president, Edgefield.

Fairfield County Good Roads Club, J. Q. Davis, president, Winnsboro; A. Homer Brice, secretary, Winnsboro.

Greenville County Good Roads Association, William G. Sirrine, president, Greenville.

Kershaw County Good Roads Association, M. C. West, president, Camden.

Lancaster County Good Roads Association, W. U. Clyburn, president, Camden.

Marion County Road and Highway Commission, L. D. Lide, clerk, Marion.

Newberry County Good Roads Association, Dr. W. C. Brown, president, Newberry.

Orangeburg County Good Roads Association, F. J. D. Felder, president, Orangeburg.
Pickens County Good Roads Association, W. T. O'Dell, president, Liberty.
Spartanburg County Good Roads Association, S. T. D. Lancaster, president, Pauline.
Sumter County Good Roads Association, S. A. Harvin, president, Sumter.
Union County Good Roads Association, J. H. Spears, president, Union.
Williamsburg County Good Roads Commission, J. A. Kelly, president, Kingstree.
York County Good Roads Association, R. T. Fewell, president, Rock Hall.

South Dakota

Sioux Falls-Salem-Iroquois Highway Association, L. V. Schneider, president, Salem; O. P. Schmidt, secretary-treasurer, Salem.
South Dakota Division of the Meridian Road, S. H. Edmunds, secretary, Yankton.
South Dakota Good Roads Association, J. W. Parmley, president, Ipswich; H. F. Brownell, secretary-treasurer, Sioux Falls.
South Dakota Scenic Highway Association, Harry Wentsy, president, Rapid City; E. K. Mather, secretary, Micthell.
Twin City-Aberdeen-Yellowstone Park Trail, J. E. Prindle, president, Ismay; F. A. Finch, secretary-treasurer, Lemmon.
Sioux Falls-Salem-Huron Road Association, W. F. Alguire, president, Ellis; Ray Bowden, secretary, Ellis.
Beadle County Good Roads Club, A. Lampe, president, Huron; J. McD. Campbell, secretary, Huron.
Hanson County: Alexandria Good Roads Club, John Munsen, president, Alexandria; John Dobson, secretary, Alexandria.
Hutchinson County: Meridian Road Club, A. A. Wipf, president, Freeman; A. J. Waltner, secretary, Freeman.
Lawrence County: Lead-Terry Good Roads Association, H. L. Curran, secretary, Lead.
Sioux Falls Good Roads League, J. L. White, secretary, Sioux Falls.
Roberts County Meridian Road Committee, Henry S. Morris, chairman, Sisseton.

Tennessee

Tennessee Highway Association, J. N. Fisher, president, Morristown; D. M. Armstrong, secretary, Memphis.
Memphis-Bristol Highway Association, C. C. Gilbert, president, Memphis.
Western Tennessee Good Roads and Drainage Association, J. D. Johnson, president, Henderson.
Knoxville-Chattanooga Highway Association, S. H. Thompson, president, Athens.
Anderson County Good Roads Association, W. L. Owen, president, Clinton.
Bradley County Good Roads Association, J. W. Beard, president, Cleveland.
Cocke County Good Roads Association, chairman, W. D. McSween, Newport.
Fayette County Good Roads Association, E. A. Maddox president, Somerville.
Grainger County Good Roads Association, Dr. A. E. Foster, president, Blaine.
Knox County Road and Park Association, Cyrus Kehr, president, 607 Empire Building, Knoxville.
Loudon County Good Roads Association, J. W. Norwood, president, Martel.
McMinn County Good Roads Association, R. J. Fisher, president, Athens.

Madison County Good Roads Association, R. A. Hurt, secretary, Jackson.

Monroe County Good Roads Association, Charles A. Lowry, president, Madisonville.

Roane County Good Roads Association, W. C. Shaw, president, Harriman.

Texas

Texas Good Roads Association, J. W. Warren, president, San Antonio; Homer D. Wade, secretary, Stamford.

Texas Industrial Congress, Henry Exall, president, Dallas, W. C. Barrickman, secretary, Dallas.

Texas Division of Meridian Highway

San Antonio to Galveston Division.

San Antonio-Laredo Division, D. E. Colp, president, Fort Worth; W. H. Beck, secretary, Fort Worth.

San Antonio-Laredo Highway, D. E. Colp, president, San Antonio; W. Trickey, secretary, Pearsall.

San Antonio-Atascosa and Gulf Highway Association, H. M. Martin, president, Pleasanton; W. L. Dunne, secretary, Pleasanton.

San Antonio-Port O'Connor Highway, J. W. Warren, president, San Antonio; W. H. Vernor, secretary, San Antonio.

San Antonio-Blanco and Granite Highway Association, Chas. E. Crist, president, Blanco City; R. E. Johnson, secretary, Marble Falls.

Gulf Coast Good Roads Association, J. H. Hawley, secretary-manager, Galveston.

East Texas Good Roads Association, G. A. Bodenheim, president, Longview; Dr. A. L. Hathcock, secretary, Palestine.

Alamo-Victoria-San Jacinto Highway, Judge J. P. Pool, president, Victoria; D. E. Colp, secretary, San Antonio.

Bell County: Good Roads Association, B. B. Buckeridge, secretary, R. L. Bennett, manager, Temple.

Bee County Good Roads Association, J. B. Daniels, secretary, Beeville.

Bexar County Highway Division of the San Antonio Chamber of Commerce, A. M. Fischer, president, San Antonio; D. E. Colp, secretary, San Antonio.

Blanco County Good Roads Club, Percy T. Brigham, president, Blanco City; Wily Kreuger, secretary, Twin Sisters.

Brazos County Good Roads Club, L. M. Hewitt, secretary, Bryan.

Burnett County Good Roads Association, C. A. Read, president, Marble Falls; M. E. Fabion, secretary, Marble Falls.

Cameron County Good Roads Association, S. C. Tucker, president, Brownsville; L. A. Whitney, secretary, Brownsville.

Colorado County: Eagle Lake Good Roads Club, Frits Engelhart, president, Eagle Lake.

Crockett County: Ozona Good Roads Association, Chas. E. Davidson, secretary, Ozona.

Dallas County Good Roads Club, J. F. Zang, president, Dallas.

Falls County Good Roads Club, G. H. Carter, president, Marlin.

Guadalupe County Good Roads Club, J. M. Abbott, president, Seguin; C. F. Blumber, secretary, Seguin.

Guadalupe County Good Roads Association, Chas. Blumberg, president, Seguin; T. L. Abbott, secretary, Seguin.

Hopkins County Good Roads Club, F. W. Mack, secretary, Sulphur Springs.

Jefferson County Good Roads Club, T. W. Larkin, secretary, Beaumont.

Jim Wells County: Business Men's Good Roads Club, J. H. Briggs, president, Alice; Phil Hobbs, secretary, Alice.

Karnes County Good Roads Association, Dr. King, president, Karnes City; W. H. Howard, secretary, Karnes City.

Kendall County Good Roads Association, Dr. J. F. Nooe, president, Boerne; H. H. McFarland, secretary, Boerne.

Kerr County Good Roads Club, Mr. Schultz, secretary, Kerrville.

Lampasas County Good Roads Club, J. H. H. Berry, president, Lampasas; J. E. Verner, secretary, Lampasas.

Medina County: Devine Good Roads Club, J. W. Fullerton, president, Devine; Mack Kerchville, secretary, Devine.

Newton County Good Roads Association, I. B. Alford, president, Burkeville; L. M. Autrey, Newton, secretary.

Orange County Good Roads Association, Geo. W. Bancroft, president, Orange.

Robertson County: Calvert Good Roads Association, E. J. McGirick, secretary, Calvert.

Franklin Good Roads Club, F. S. Estes, Franklin.

Wilson County Good Roads Association, W. H. King, president, Stockdale, T. C. Richardson, secretary, Sutherland Springs.

Note: Practically every town of 5000 inhabitants or over has an active commercial club, and in every case these organizations act as good roads clubs and make the road propaganda one of their chief departments of work. They can be reached by addressing: Secretary, Commerical Club, at the town desired.

Vermont

Greater Vermont Association, Guy W. Bailey, president, Junction; J. P. Taylor, secretary, Burlington.

West River Valley Association, J. H. Ware, president, Townshend; H. C. Rice, secretary, Brattleboro.

Addison County: East Middlebury Improvement Society, Edward M. Day, president, East Middlebury; J. A. Douglas, secretary, East Middlebury.

Bennington County Improvement Association, Guy B. Johnson, president, Center; H. N. Moore, secretary, Manchester.

Arlington Village Improvement Society, Mrs. I. E. Bronson, secretary, Arlington.

Bennington County: North Bennington Improvement Association, Mrs. Edward D. Weeling, president, North Bennington; Myron H. Jones, secretary, North Bennington.

Rutland County: Danby and Mt. Tabor Improvement Society, W. H. Griffith, president, Danby; Mrs. Mabel Tabor, secretary, Danby.

Windsor County: Woodstock Improvement Society, F. T. Kidder, president, Woodstock; Miss Bertha S. Knapp, secretary, Woodstock.

Virginia

Virginia Road Builders' Association, C. B. Scott, president, Lynchburg; C. T. Scott, secretary, Waynesboro.

Richmond Society of Engineers, Arthur Scrivenor, president, Richmond; James Bolton secretary Richmond.

Amelia County Good Roads Association, H. F. Green, president, Amelia Court House.

Campbell County Good Roads Association, Eugene Ould, president, Evington; W. L. Garbee, Lawler.

Good Roads Association, Rustburg.

Charlotte County Good Roads Association, B. P. Eggleston, president, Charlotte Court House.

Chesterfield County Good Roads Association, Howard Swineford, president, Richmond.

Dinwiddie County Good Roads Association, J. E. Perkinson, chairman, Dinwiddie.

Fauquier County Good Roads Association, P. T. Crosby, president, Warrenton.

Halifax County Good Roads Association, W. Holt Edwards, president, Houston.

Lunenburg County Good Roads Association, E. P. Wallace, president, Meherrin.

Nansemond County Good Roads Association, R. H. Beamon, president, Beamon.

Pittsylvania County Good Roads Association, J. L. Carter, president, Chatham.

Shenandoah County Good Roads Association, M. H. Bowman, president, Woodstock.

Spotsylvania County: Fredericksburg Good Roads Association, E. D. Cole, president, Fredericksburg; Thomas H. Harris, secretary-treasurer, Fredericksburg.

Wise County Good Roads Association, John W. Chalkley, president, Big Stone Gap.

Washington

Washington State Good Roads Association, John A. Rea, secretary, Tacoma.

Chelan County Good Roads Association, Harry Shotwell, president, Wenatchee; H. A. Saunders, secretary, Wenatchee.

Clarke County: Dole Good Roads Association, C. H. Muncton, president, Dole; A. J. McPherson, secretary, Dole.

Ferry County Good Roads Associatin, W. T. O'Connell, president, Republic; S. H. Richardson, secretary, Republic.

Grant County Organization, William Ragless, president, Quincy; Leo G. Titus, secretary, Ephrata.

Island County: Good Roads Association of District No. 5, C. S. Halversen, president, R. D., Clinton; A. K. Hanson, secretary, R. D. Langley.

Kitsap County: Winslow Good Roads Association, Winslow.

Pearson Good Roads Association, W. H, Babcock, president, Pearson; G. Fryholm, secretary, Pearson.

Brownsville Good Roads Association, Jerry Beherns, president, Brownsville; T. U. Townsend, secretary, Brownsville.

Burley Improvement Club, H. W. Stein, secretary, Burley.

Kittitas County: Good Roads Association of Kittitas County, Soren Sorenson, president, Ellensburg; H. M. Hathaway, secretary, Ellensburg.

Klickitat County: Good Roads Association of Road District No. 4, J. S. Eddings, president Centerville; J. A. Miller, secretary Centerville.

Lincoln County Good Roads Association, Albert F. Kramer, president, Almira; Guy G. Harvey, secretary, Davenport.

Oroville Good Roads Association, Oroville.

Mason County: Matlock Good Roads Association, Fred Ferris, president, Matlock; M. J. Dunkelberger, secretary, Matlock.

Okanogan County Good Roads Association, George Bailey, secretary, Riverside.

Pierce County: Longbranch Good Roads Association & Improvement Club, S. S. Watkinson, secretary, Longbranch.

Skamania County: Underwood Good Roads Association, W. F. Cash, secretary, Underwood.

Hood Good Roads Association, F. W. Dehart, secretary, Hood.

Cook Good Roads Association, P. S. C. Wills, secretary, Cook.

Collins Good Roads Association, Alex. McKeighan, secretary, Collins.

Home Valley Good Roads Association, A. B. Hutcheson, secretary, Home Valley.

Butler Good Roads Association, F. S.. Munn, secretary, Butler.

Cape Horn Good Roads Association, M. B. Stevenson, secretary, Cape Horn.

Snohomish County Good Roads Association, Dr. W. C. Cox, Everett; W. W. Blaine, secretary, Everett.

Spokane County Good Roads Association, W.H. Cowles, president, Spokane; Frank W. Guilbert, secretary 411 Empire State Building, Spokane.

Walla Walla County: Good Roads Association, W. M. Cook, president, College Place; John Moyer, secretary, College Place.

Wisconsin

Lake to River Association, Guido Hansen, president-treasurer, Milwaukee; Malcolm J. Mackinnon, secretary, Milwaukee.

Ooconomowoc-Milwaukee Road Association, L. J. Petit, Wisconsin National Bank, Milwaukee.

Wisconsin Highway Commissioners' Association, H. J. Knelling, president, Pereles Building, Milwaukee; G. H. Mainwaring, secretary-treasurer Gotham.

Trempealeau County Good Roads Association, F. A. George, president, Whitehall; G. O. Linderman, vice-president, Osseo; J. A. Markham, secretary, Independence; Dr. G. H. Lawrence, treasurer, Galesville.

Wyoming

Association for promoting "Black Hills-Yellowstone Park Highway" N. E. Franklin, president, Deadwood, S. D.; J. D. Gallup, vice-president, Buffalo.

Northern Wyoming Good Roads Association, Hayden M. White, president, Buffalo; C. A. Harmon, secretary, Upton.

Wyoming Highway Association, Frank Wood, president, Casper; J. D. Kilborn, secretary, Elk Mountain.

Albany County Good Roads Association, Elmer Lovejoy, president, Laramie; Robert W. Innes, secretary, Laramie.

Carbon County Good Roads Association, Raymond Barber, president, Rawlins; Homer A. Menice, secretary, Rawlins.

Converse County: Good Roads Club of Douglas, Jacob Jenne, president, Douglas; Henry J. Bollin, secretary, Douglas.

Laramie County Good Roads Association, H. P. Hynds, president, Cheyenne; C. A. Lane, secretary, Cheyenne.

MILEAGE OF IMPROVED AND UNIMPROVED ROADS

Complete information is not available as to mileage of improved roads in all of the states or mileage of roads constructed with the aid of State funds. In the following table references are made to foot notes showing the latest year for which information is given:

	TOTAL MILEAGE	TOTAL MILEAGE IMPROVED	MILES IMPROVED WITH STATE AID
Alabama	49,639	5,491*	
Arizona	5,987	273¶	220*
Arkansas	36,445	1,085¶	
California	48,069	8,788*	200*
Colorado	30,421	1,600*	
Connecticut	12,583	3,100‡	978§
Delaware	3,000	220*	134*
Florida	17,954	2,175¶	
Georgia	83,986‡	22,043‡	
Idaho	18,403	510¶	
Illinois	94,141	9,000¶	185*
Indiana	63,370†	26,831†	
Iowa	102,427	2,505¶	
Kansas	98,302	375¶	
Kentucky	53,744	10,115¶	
Louisiana	24,962	477†	250†
Maine	25,528	3,044†	883†
Maryland	17,025*	3,431*	1,430*
Massachusetts	17,272	8,749*	1,391*
Michigan	102,427	8,698*	2,344*
Minnesota	79,323	6,206‡	1,279‡
Mississippi	44,072‡	345‡	
Missouri	107,923	4,755¶	
Montana	23,319	95¶	
Nebraska	80,388	249¶	
Nevada	12,751	62‡	16‡
New Hampshire	15,116	1,745§	766§
New Jersey	14,842	3,613†	1,684†
New Mexico	16,920	705†	
New York	79,279	17,200*	5,000*
North Carolina	48,285	3,440†	
North Dakota	61,593	161‡	
Ohio	88,861	24,462*	415*
Oklahoma	79,883†	499†	
Totals carried forward	1,658,240	182,047	17,170

* 1913. † 1912. ‡ 1911. § 1910. ¶ 1909.

	TOTAL MILEAGE	TOTAL MILEAGE IMPROVED	MILES IMPROVED WITH STATE AID
Totals brought forward	1,658,240	182,047	17,170
Oregon	35,896*	4,296*	
Pennsylvania	87,387	3,472‡	836‡
Rhode Island	2,121	1,246*	324*
South Carolina	45,549*	5,888*	
South Dakota	56,354	286¶	
Tennessee	45,913	5,354¶	
Texas	128,971	4,896¶	
Utah	8,320	1,653*	952*
Vermont	14,406	3,078*	1,431*
Virginia	43,399	3,732*	2,052*
Washington	39,051	3,950†	346†
West Virginia	32,109	591¶	
Wisconsin	61,090	11,630*	1,463*
Wyoming	10,569	416¶	
Totals	2,269,375	232,535	24,574

* 1913. † 1912. ‡ 1911. ¶ 1909.

CONVICT LABOR FOR ROAD IMPROVEMENT

Convict labor has been successfully used in a number of the States for road construction. Previous issues of the *Good Roads Year Book* have included detailed progress reports from each State. Such reports are omitted in this issue as they would be largely a repetition of the matter which has previously appeared. In lieu of the detailed statements a summary of the data obtained is set forth as follows:

Cost of Convict Labor

In Alabama, with an average of about 300 convicts, the cost for each convict runs from 40 cents to 65 cents per day. In Colorado the average cost is estimated at about 80 cents per convict per day, but this is an average of the entire cost of the camps, including the feeding of horses, and other incidentals. In Louisiana, the average cost of feeding, guarding, etc., is given at 40 cents per convict per day. In Montana the cost for guarding, feeding, supervision, medical attention, etc., is given as $1 per day. In North Carolina, where a number of counties are using their convicts, the cost varies from 42 cents to 72 cents per convict per day, and it is estimated that the average cost for the State would be from 55 cents to 60 cents. In Oregon the average cost is given as $14 per month, which on a twenty-six day basis, would be about 54 cents. In Virginia the average cost per ten hour working day was 50.7 cents in 1913. These reports indicate by their wide divergence considerable difference in practice in making up statements showing the cost of convict labor. Undoubtedly, in some of the States items are included which in others are omitted. It would seem, however, that 40 cents per day for guarding, feeding, and supervision is about the lowest figure obtainable with adequate results and that the maximum should not, under normal conditions, run higher than 65 cents or 70 cents. The necessity for some standardization of cost keeping and a study of the conditions under which convict labor is economical, is apparent from a study of reports submitted.

Relative Efficiency of Convict Labor

The State highway engineer of Alabama claims that convict labor when properly managed is more effective than paid labor.

The State highway engineer of Colorado claims that convict labor is nearly as efficient as free labor. The State highway engineer of Louisiana considers it to be much more satisfactory than free labor. The State highway engineer of Minnesota considers convict labor as effective as free labor. The State geologist of North Carolina, under whom considerable convict labor work has been done, considers that the work of the convicts is equal to and in many instances is more effective, than that of paid labor. This contention is supported by experience in Oregon. In Virginia, where a very large amount of work has been done by convicts, the State highway commissioner considers convict labor to be equally as good as free labor. The considerations which operate in favor of convict labor as compared with free labor are, first, that the convict is a constant factor, where as free labor is a varying factor; the engineer or foreman in charge knows almost with exactness the amount of labor upon which he can depend and the exact times at which it will be available; second, the convict is amenable to discipline in a greater degree than free labor; third, the convicts acquire a skill and efficiency in road work which in time renders them a trained specialized force of road laborers to a much greater degree than is possible with a constantly shifting force of free laborers; fourth, the health of the convict is so much better on road work than on prison work, his freedom of action much more pronounced, and, as a rule, the work so much more congenial, that he is inclined to work faithfully and efficiently to avoid a transfer to other work.

Conditions Under Which Convict Labor on Road Work is Desirable

A much more general use of convict labor for road work in the South than in the North is due partly to the fact that in the South weather conditions make possible a much longer working season for road work than in the North, and partly to the fact that the convicts in the South are mostly made up of persons who are used to manual outdoor labor. Consideration must be given to the question as to what can be done to utilize the convict labor during the season when weather conditions make outdoor work impracticable. Consideration must also be given to the question as to whether white convicts from large cities unaccustomed to manual labor can be used to advantage on road work. The effect upon the convict of this outdoor work, where he is exposed to almost constant public inspection may be detrimental upon some classes of convicts and may be very beneficial upon other classes. The question is therefore one to be studied not along general lines but with reference to the particular problems prevailing in each State.

As to the character of road work upon which convicts may be used with economy, it may be stated that experience in Virginia tends to show that the labor of convicts is economical on heavy work but more expensive than free labor on light work. This is due to the fact that the proportionate cost of guarding, feeding, maintaining, and supervising each convict is much greater where the force is small than where a considerable number of the convicts are utilized. In some States the honor system has been followed whereby the convicts are worked without guards. Among the States which have tried this plan are Colorado and Washington, with results which are claimed to be satisfactory. New Jersey has been conducting some experiments in the use of convicts on road work and has found that under existing conditions it is not economical to use convicts for repair work, where the men have to be moved from place to place. The State highway department is now using convicts on new construction and finds the labor more satisfactory than the ordinary free laborers available for such work. Detailed information as to the economy of the plan is not yet available.

References for Further Information

The States in which convict labor has been most extensively used for road construction are Virginia, North Carolina, Georgia, Alabama, Louisiana, Colorado and Washington. Information should therefore be obtainable from George P. Coleman, State highway commissioner, Richmond, Virginia; Dr. Jos. Hyde Pratt, State geologist, Chapel Hill, North Carolina; R. E. Davison, chairman, prison commission of Georgia, Atlanta; and Dr. S. W. McCallie, State geologist of Georgia, Atlanta; W. S. Keller, State highway engineer, Montgomery, Alabama; W. E. Atkinson, State highway engineer, New Orleans, Louisiana; J. E. Maloney, secretary, State highway commission; Denver, Colorado; Wm. R. Roy, State highway commissioner, Olympia, Washington. Investigations have been made relating to convict labor along various lines by Prof. E. Stagg Whitin, secretary, National Prison Labor Committee, New York City.

MANUFACTURERS

Manufacturers of Road Machinery and Equipment

Abenaque Machine Works (rock drills), F. H. Greaney, manager, Boston, Massachusetts.

Acme Equipment and Engineering Company, J. Webb Saffold, secretary, Cleveland, Ohio.

Acme Road Machinery Company, W. A. Cook, president and general manager; James W. Jones, treasurer: David B. Cook, secretary, Frankfort, N. Y. (advertisement page 138).

Acme Wagon Company (dump wagon), Emigsville, Pennsylvania.

J. D. Adams and Company (roader, grader and tractor), W. R. Adams, assistant manager, Indianapolis, Indiana.

Albany Belting and Supply Company (bitumen heater), Matthew Van Alstyne, president; A. Y. Van Alstyne, vice-president; William D. Baker, secretary; Charles H. Hay, treasurer.

Allis-Chalmers Company (gyratory crusher), Otto H. Falk, receiver; H. Schifflin, manager, crushing and cement machinery department, Milwaukee, Wisconsin.

American Cement Machine Company, Inc. The (mixer), 10 Johnson Street, Keokuk, Iowa.

American Harrow Company, Detroit, Michigan.

American Process Company (rock and sand dryers), 68 Williams Street, New York City.

American Road Machinery Company, Kennett Square, Pennsylvania.

American Steel Scraper Company, W. F. Kilborn, general manager, Sidney, Ohio.

Ames Plow Company, Oliver Ames, president; Frederick B. Hill, Boston, Massachusetts.

Archer Iron Works (concrete mixer), 2400 34th Place, Chicago, Illinois.

Armstrong Manufacturing Company, Waterloo, Iowa.

Atlas Engineering Company (mixer), 790 Thirtieth Street, Milwaukee, Wisconsin.

Auburn Wagon Company, Lee Roy Myers, president; Max Robinson, treasurer and manager, Martinsburg, West Virginia.

Austin-Western Company, Ltd., W. T. Beatty, president and general manager; W. I. Babb, vice-president and secretary; H. S. Maclay, treasurer; S. F. Beatty, assistant manager, Karpen Building, Chicago, Illinois (advertisement page 143).

Earle C. Bacon (rock crusher), 26 Cortland Street, New York City.

Badger Concrete Mixer and Machinery Company, Watkins Building, Milwaukee, Wisconsin.

The Bain Wagon Company, W. W. Strong, Kenosha, Wisconsin.

A. D. Baker Company, A. D. Baker, vice-president, Swanton, Ohio.

The Baker Manufacturing Company (road graders), M. W. Baker, president, 337 W. Madison Street, Chicago, Illinois.

Berger Manufacturing Company (steel reinforcement), Canton, Ohio.

Bethlehem Steel Company, J. V. Dippery, chief clerk, South Bethlehem, Pennsylvania.

Bituminized Road Implement Company, Malden, Massachusetts.

Blystone Machinery Company, Cambridge Springs, Pennsylvania.

Bolte Manufacturing Company, The (mixer), Kearney, Nebraska.

The Browning Steam Shovel Company, main office and works, Mansfield, Ohio.

Bucyrus Company (steam shovels), W. W. Coleman, president; E. K. Surgart, vice-president; G. A. Morison, secretary; D. P. Ells, treasurer, South Milwaukee, Wisconsin.

Buffalo Pitts Company (road roller), F. G. Batchellor, sales manager, Buffalo, New York.

Buffalo Steam Roller Company, J. F. Richardson, sales manager, Buffalo, New York (advertisement page 148).

Bull Dog Dump Wagon Company The, 205–06 Boston Building, Kansas City, Missouri.

The Burch Plow Works Company, J. L. Morrow, secretary, Crestline, Ohio.

A. Burlingame Company (road spraying machine), Charles D. Parker, manager, Worcester, Massachusetts.

Butterworth and Lowe (concrete mixer), 17 Huron Street, Grand Rapids, Michigan.

The Call-Watt Company (road graders), Richmond, Virginia.

Canton Culvert Company, Julius H. Schlafly, president; Perry Van Horne, secretary, treasurer and general manager; Chas. Haines, vice-president and superintendent, Canton, Ohio (advertisement page 195).

J. I. Case Threshing Machine Company, Frank Bull, president; Fredk. Robinson, vice-president; F. R. Norton, treasurer; Richards S. Robinson, secretary; R. B. Coleman, sales Manager, Racine, Racine County, Wisconsin.

Chain Belt Company (concrete mixers), C. W. Levalley, president; Wm. C. Sargent, vice-president and secretary; Wm. C. Frye, treasurer, Milwaukee, Wisconsin.

Chalmers and Williams, Inc. (gyratory crusher), Thos. S. Chalmers, president; Norman Williams, vice-president and treasurer; J. W. Young, second vice-president; W. B. Easton, secretary, Chicago Heights, Illinois.

Chamberlain Road Machine Company (graders, tractors and drags), Hutchinson, Minnesota.

Chicago Concrete Machinery Company, Payne G. West, secretary, 221 Grand Avenue, Milwaukee, Wisconsin.

Chicago Pneumatic Tool Company, George A. Rees, general manager, Fisher Building, Chicago, Illinois.

George C. Christopher and Son (concrete mixer), Wichita, Kansas.

Cleveland Pneumatic Tool Company, The, Cleveland, Ohio.

Climax Road Machine Company, J. R. Manning, president; S. Jones Philips, vice-president; T. R. Clark, secretary-treasurer, Marathon, New York.

Columbia Wagon Company, W. T. Garrison, president; H. F. Yergey, treasurer and manager; Edward B. Smith, secretary, Columbia, Pennsylvania.

Concrete Form and Engine Company, 503 Wayne County Bank Building, Detroit, Michigan.

Cropp Concrete Machinery Company (concrete mixer), 118 N. La Salle Street, Chicago, Illinois.

Deere and Company (road plow), Moline, Illinois.

Des Moines Bridge and Iron Company, Curry Building, Pittsburgh, Pennsylvania.

Disc Grader and Plow Company, Allen L. Powlinson, president, Minneapolis, Minnesota.

Eagle Wagon Works, Frank E. Swift, president; Thomas M. Osborne, vice-president; Courtney C. Avery, secretary; Clarence F. Baldwin, treasurer, Auburn, New York.

The East Iron and Machine Company (portable asphalt paving plant), Lima, Ohio.

Emerson-Brantingham Company, successors to The Geiser Manufacturing Company (road rollers), Waynesboro, Pennsylvania.

Enterprise Manufacturing Company (road roller), Columbiana, Ohio.

The Erie Machine Company, P. W. Dietley, manager, Erie, Pennsylvania.

E. D. Etnyre and Company, Oregon, Illinois.

Eureka Machine Company, Inc., Lansing, Michigan.

Everett Manufacturing Company (dumping boxes), 48 Lake Street, Newark, New Jersey.

Fairbanks, Morse and Company (tractors), Wabash Avenue and Eldredge Place, Chicago, Illinois.

Fairbanks Steam Shovel Company, Marion, Ohio.

A. B. Farquhar Company, Ltd. (engines), York, Pennsylvania (advertisement page 153).

Farrell Foundry and Machine Company, Franklin Farrell, president; Frank E. Hoadley, secretary; Charles F. Bliss, treasurer; Franklin Farrell, Jr., vice-president, Ansonia, Connecticut.

Flinchbaugh Manufacturing Company (road roller), York, Pennsylvania.

Francis Machinery Company, 4 Market Street, St. Louis, Missouri.

Frick Company, Inc. (engines), A. O. Frick, president; Esra Frick, vice-president and general manager; W. H. Manns, secretary; D. Norris Benedict, treasurer.

"Friend" Manufacturing Company, Casport, New York.

Galion Iron Works Company, Henry Gottdiener, president; G. L. Stiefel, vice-president; D. C. Boyd, secretary-manager; L. M. Liggett, treasurer, Galion, Ohio (advertisement page 154).

Gardner Crusher Company, Ed. E. Gauche, treasurer, 556 W. 34th Street, New York, New York.

Girnau Manufacturing Company, 121 South River Street, Eau Claire, Wisconsin.

Glen Wagon Works, Harry Glen, manager, Seneca Falls, New York.

Glide Road Machine Company, Clyde Waterman, president, Minneapolis, Minnesota.

Globe Machinery and Supply Company (road drags), Des Moines, Iowa.

Good Roads Machinery Company, Kennett Square, Pennsylvania (advertisement page 156).

Griffith Iron Works Company, George Griffith, Jr., president, St. Louis, Missouri.

The Guelich Paving Company (street paving machine), Otto E. Guelich, president, 1412 Great Northern Building, Chicago, Illinois.

Gunn's Road Builder (grader), D. B. Gunn, Red Oak, Iowa.

Hall-Holmes Manufacturing Company (gasoline engine), 220 Oak Street, Jackson, Michigan.

The Hanna Manufacturing Company (engineering instruments), Troy, New York.

The Hart-Parr Company (tractor), C. W. Hart, president, Charles City, Iowa.

Haywood Wagon Company, John W. Haywood, general manager, Newark, New York.

Heider Manufacturing Company, Carroll, Iowa.

Hetherington and Berner (asphalt paving plants), Indianapolis, Indiana.

The Hobbs Concrete Machinery Company, N. F. Hobbs, sales-manager, Detroit, Michigan.

Holt Caterpillar Company (caterpillar engine), Peoria, Illinois (advertisement page 160).

Huber Manufacturing Company (road roller), S. E. Barlow, president and general manager; F. A. Huber, vice-president; E. C. L. Barlow, treasurer; E. Durfee, secretary, Marion, Ohio (advertisement page 161).

Humboldt Manufacturing Company (testing apparatus), 2014 Nebraska Avenue, Chicago, Illinois.

Chas. Hvass and Company (road machinery), B. Chas. Hvass, Wm. B. Lorenso, 509–11 East 18th Street, New York City (advertisement page 159).

Ideal Concrete Machinery Company, M. Wetsstein, president and treasurer; G. B. Pulfer, vice-president and general manager; G. B. Hopkins, secretary, South Bend, Indiana.

Imperial Machinery Company, Inc. (tractor), 1611 Central Avenue, Minneapolis, Minnesota.

Indiana Road Machine Company, Jno. Landenberger, president and treasurer; Chas. Stockman, Jr., secretary, Fort Wayne, Indiana.

Ingersoll-Rand Company (rock drills), W. L. Saunders, president; George Doubleday, vice-president; W. R. Grace, vice-president and treasurer; George R. Elder, vice-president; J. S. Phipps, vice-president; F. A. Brainard, secretary, 11 Broadway, New York City.

International Harvester Company of America (tractors), Harvester Building, Chicago, Illinois (advertisement page 162).

International Instrument Company, Arthur Kendrick, treasurer, 23 Church Street, Cambridge, Massachusetts (advertisement page 165).

Iroquois Iron Works, Arthur W. Sewall, president; A. D. Andrews, vice-president; Ira Atkinson, treasurer, Buffalo, New York (advertisement page 161).

Jaeger Machine Company (concrete mixer), Columbus, Ohio (advertisement page 164).

Jeffery Manufacturing Company, East First Avenue, Columbus, Ohio.

The Kelly Manufacturing Company (road drags), Waterloo, Iowa.

Kelly-Springfield Road Roller Company, Chas. M. Greiner, president, Springfield, Ohio.

The Kent Machine Company, M. L. Garrison, president; W. S. Kent, vice-president; F. H. Merrell, secretary-treasurer, Kent, Ohio.

Kent Mill Company (rock crusher), 10 Rapelyea Street, Brooklyn, New York.

Kentucky Wagon Manufacturing Company (dump wagons), Louisville, Kentucky.

The Kilbourne and Jacobs Manufacturing Company (scrapers and wheelbarrows), Columbus, Ohio.

The Kindling Machinery Company (street sweeper), H. Buchenberger, general manager, Milwaukee, Wisconsin.

Kinnard-Haines Company (gasoline tractor), O. B. Kinnard, 867 44th Avenue, Minneapolis, Minnesota.

The Knickerbocker Company (mixers), W. B. Knickerbocker, Jackson, Michigan.

Koehring Machine Company, Wm. J. Koehring, president; Richard Keil, vice-president; P. Koehring, secretary-treasurer, 615–17 Germania Building, Milwaukee, Wisconsin (advertisement page 166).

Kolesch and Company, Inc. (surveyors' instruments), Emilie Kolesch, president; Percy A. Kolesch, treasurer, 138 Fulton Street, New York City.

Lansing Company, formerly Lansing Wheelbarrow Company (concrete mixers, etc.), E. W. Sparrow, president; F. Thoman, vice-president; A. C. Stebbins, secretary and general manager; H. E. Moore, treasurer Lansing, Michigan.

Lawrence Pump and Engine Company, Lawrence, Massachusetts.

Linder Grader Company, Paul C. Linder, Matthews, Indiana.

Link-Belt Company, Inc. (hoisting cranes), James M. Dodge, chairman; Charles Piez, president and treasurer; Glenn G. Howe, vice-president, Chicago, Illinois.

The Matchless Street Cleaner Company, Troy, New York.

E. J. McHarg and Company (concrete mixers), E. J. McHarg, L. R. McHarg, 3 Crandall Street, Binghamton, New York.

McKiernan-Terry Drill Company (rock drill), 117 Broadway, New York, New York.

Lewis McNutt (clay, sewer, block and pipe), 14 South Walnut Street, Brazil, Indiana.

Marion-Osgood Company (traction shovels), 51 State Street, Albany, New York.

Marion Steam Shovel Company, Geo. W. King, president and general manager; Frank A. Huber, vice-president and treasurer; R. H. Reidenbaugh, secretary, Marion, Ohio.

Marsh-Capron Manufacturing Company (concrete mixers), H. M. Capron secretary, Old Colony Building, Chicago, Illinois.

The Mercury Manufacturing Company, Chicago, Illinois.

Milburn Wagon Company, H. W. Suydam, president, Toledo, Ohio.

The Miles Manufacturing Company (concrete mixers), D. P. Vining, Jackson, Michigan.

Milwaukee Concrete Mixer and Machinery Company, A. G. Bodden, secretary-treasurer, Milwaukee, Wisconsin (advertisement page 168).

Minneapolis Steel and Machinery Company (road tractor), Minneapolis, Minnesota.

Monarch Road Roller Company, Nat Tyler, Jr., president, Groton, New York.

N. S. Monroe and Sons (Monroe road machine), Arthur, Illinois.

Morse Twist Drill and Machine Company, New Bedford, Massachusetts.

Thomas Moulding Company, T. C. Moulding, Chicago, Illinois.

Municipal Engineering and Contracting Company (concrete mixers), F. C. Austin, president, 607–11 Railway Exchange Building, Chicago, Illinois,

Munnsville Plow Company, J. E. Sperry, president, Munnsville, New York (advertisement page 195).

The New England Cement Gun Company. Wm. L. Church, president; Nils F. Ambursen, vice-president; Chas. E. Parsons, secretary and treasurer, 88 Pearl Street, Boston, Massachusetts.

New Holland Machine Company, P. S. Hess, secretary, New Holland, Pennsylvania.

The "New-Way" Motor Company, E. W. Goodnow, secretary, Lansing, Michigan.

Nims Concrete Machinery (concrete mixer), Philadelphia, New York.

Northwestern Steel and Iron Works (mixer). Thomas W. Resholt, vice-president, Eau Claire, Wisconsin.

Novo Engine Company, C. E. Bement, secretary and manager, Lansing, Michigan.

Ohio Ceramic Engineering Company (concrete mixers), Cleveland, Ohio.

The Ohio Manufacturing Company, A. B. Whitney, president and treasurer; W. E. Robinson, vice-president; Chas. C. Kouns, secretary, Upper Sandusky, Ohio.

The Ohio Road Machinery Company, W. A. Heusner, president; D. E. Graves, vice-president; C. H. Dudley, secretary-treasurer, Oberlin, Ohio.

Oliver Chilled Plow Works, South Bend, Indiana.

The Wm. J. Oliver Manufacturing Company (dump and spreader cars). Knoxville, Tennessee.

The Original Gas Engine Company, R. E. Olds, president; C. S. Smith, sales manager, Lansing, Michigan.

Oshkosh Manufacturing Company (concrete mixer), Oshkosh, Wisconsin.

Otto Gas Engine Works, 3411 Walnut Street, Philadelphia, Pennsylvania.

Overturf Mold and Mixer Company (mixers and culvert molds), Dumont, Iowa.

Pennsylvania Crusher Company, Stephen Girard Building, Philadelphia, Pennsylvania.

Petrolithic Company, The, Los Angeles, California.

Pioneer Tractor Manufacturing Company, Winona, Minnesota.

Port Huron Engine and Thresher Company, C. F. Harrington, president; H. L. Stevens, vice-president; A. E. West, general manager; D. C. Kinch, secretary; J. T. Sullivan, treasurer, Port Huron, Michigan (advertisement page 171).

Power Mining Machinery Company, 115 Broadway, New York, New York.

Quincy Engine Company, I. C. Walk, general manager, Quincy, Pennsylvania.

Raber and Lang Manufacturing Company (mixers), 202 Mill Street, Kendallville, Indiana.

Ransome Concrete Machinery Company, A. W. Ransome, Dunellen, New Jersey.

Rapid Mixer Company, 84 Porter Block, Grand Rapids, Michigan.

Revolute Machine Company (blue printing machine), J. V. McAdam, president; C. J. Everett, treasurer; R. B. Snow, sales manager, 417 East 93d Street, New York City.

Roughen, P. (adjustable street gauge), 213 Amory Street, Fond Du Lac, Wisconsin.

Ruggles-Coles Engineering Company, Wm. B. Ruggles, president; Robt. G. McGann, vice-president; Lindsay R. Christie, secretary-treasurer, 50 Church Street, New York City.

M. Rumely Company (tractors), 9271 Main Street, La Porte, Indiana.

The Russell Company, J. W. McClymonds, president; C. M. Russell, vice-president; E. C. Merwin, second vice-president and secretary; Geo. H. McCall, treasurer, Massillon, Ohio.

Russell Grader Manufacturing Company, E. E. Ellerston, president and manager; C. O. Wold, secretary-treasurer, Minneapolis, Minnesota (advertisement page 174).

Sanitary Street Flushing Machine Company, W. R. Anders, secretary, St. Louis, Missouri.

The Schaefer Manufacturing Company (concrete mixers), Park and Main Streets, Berlin, Wisconsin.

Shunk Plow Company, Bucyrus, Ohio.

Skow Manufacturing Company (road machinery), Newton, Iowa.

A. F. Smith Company, P. A. Smith, New Brighton, Pennsylvania.

T. L. Smith Company (concrete mixer), T. L. Smith, president; C. F. Smith, vice-president; W. J. Buckley, secretary-treasurer, 1304 Majestic Building, Milwaukee, Wisconsin.

Smith and Sons Manufacturing Company, William J. Smith, president; Kansas City, Missouri.

Southern Branch Petrolithic Company, New Orleans, Louisiana (advertisement page 177).

Spray Nozzle Company, George S. Crittenden, general manager, 205 Devonshire Street, Boston, Massachusetts.

R. H. Staley (tamping machines), Box 229, Springfield, Illinois.

Standard Manufacturing Company, Pliny E. Bassett, proprietor, Worcester, Massachusetts.

Standard Scale and Supply Company (concrete mixer), John C. Reed, president, 243 Water Street, Pittsburgh, Pennsylvania.

Studebaker Corporation (road machinery), J. M. Studebaker, president; Clement Studebaker, Jr., general manager; Geo. M. Studebaker, treasurer; A. R. Erksine, secretary, South Bend, Indiana.

Sturtevant Mill Company (generators), Thos. L. Sturtevant, president Clayton and Park Streets, Boston, Massachusetts.

Sullivan Machinery Company (rock drills), F. K. Copeland, president; J. Duncan Upham, treasurer; Albert Ball, mechanical engineer; Thos. W. Fry, secretary, 150 Michigan Avenue, Chicago, Ill.

Syracuse Chilled Plow Company, Carlton A. Chase, president and treasurer; Wm. W. Ward, vice-president and secretary, Syracuse, New York.

Tarrant Manufacturing Company (road oiling appliances), W. P. Tarrant, president; W. R. Wilson, treasurer, Saratoga Springs, New York.

The Thew Automatic Shovel Company, F. A. Smith, president; R. Thew, vice-president and general manager; E. M. Pierce, treasurer, Lorain, Ohio.

The Tiffin Wagon Company, W. S. Shelly, manager, Tiffin, Ohio.

Tinius Olsen Testing Machine Company, Philadelphia, Pennsylvania (advertising page 170).

Traylor Engineering and Manufacturing Company (gyratory crushers), 30 Church Street, New York City.

Trautwein Dryer and Engineering Company, 417 South Dearborn Street, Chicago, Illinois.

The Troy Wagon Works Company, Troy, Ohio.

Twentieth Century Mixer Company, Norwood, Ohio.

Universal Crusher Company, 303 North 3d Street, Cedar Rapids, Iowa.

Union Iron Works, Lackawanna Siding, Hoboken, New Jersey.

Universal Road Machinery Company, R. E. Leighton, general manager, Kingston, New York (advertisement page 187).

Utica Pipe and Foundry Company, Utica, New York.

Virginia Bridge and Iron Company, C. Edwin Michael, president; T. T. Fishburne, vice-president and treasurer; Jno. R. Parker, secretary, Roanoke, Virginia.

Wallis Tractor Company, H. M. Wallis, Jr., secretary, Cleveland, Ohio.

Waterloo Cement Machinery Company (mixers, hoists and contractors, equipment), Waterloo, Iowa.

Watson Wagon Company, A. A. Keesler, president; C. M. Grouse, vice-president; Levi S. Chapman, secretary-treasurer, Canastota, New York.

Western Wheeled Scraper Company, W. I. Babb, president; W. D. Foulke, treasurer; Frank C. Worthington, secretary, Aurora, Illinois.

Wheeling Mold and Foundry Company (rock crusher), Leroy A. Kling, sales manager, Wheeling, West Virginia.

Whitman Agricultural Company, H. L. Whitman, 6930 South Broadway, St. Louis, Missouri.

Wichita Concrete Machinery Company, 232 N. Sante Fe Avenue, Wichita, Kansas.

Wood Drill Works, Paterson, New Jersey.

The F. B. Zieg Manufacturing Company (culverts), Fredericktown, Ohio (advertisement page 196).

Manufacturers of Road Material and Engineering Equipment

Alden Speare's Sons Company (road oils), Boston, Massachusetts.

American Bridge Company of New York, George L. Denio, chief clerk, Hudson Terminal, 30 Church Street, New York City.

American Cast Iron Pipe Company, Birmingham, Alabama (advertisement page 193).

American Drafting Furniture Company, F. W. Barkley, vice-president, Rochester, New York.

American Granite Company, Otto Rathman, president, Milwaukee, Wisconsin.

American Paving and Manufacturing Company, Indianapolis, Indiana.

American Rolling Mill Company (culvert iron), Middletown, Ohio (advertisement page 194).

American Steel and Wire Company (steel reinforcement), 72 West Adams Street, Chicago, Illinois.

Amies Asphalt Company, Dr. Joseph H. Amies, 1520 Chestnut Street, Philadelphia, Pennsylvania.

Amies Road Company,. John Rice, president; W. T. Newcomb, engineer, Drake Building, Easton, Pennsylvania.

American Sheet and Tin Plate Company (culverts), H. V. Jamison, manager, Pittsburgh, Pennsylvania (advertisement page 141).

American Tar Company, Charles P. Price, manager; road department, 201 Devonshire Street, Boston, Mass. (advertisement page 140).

Arnott, Lee (culvert pipe), 518 Little Building, Lincoln, Nebraska.

Asphalt Block and Pavement Company (blocks and tiles), Ohio Building, Toledo, Ohio.

Atlanta Gas Light Company, R. C. Congdon, manager, Electric and Gas Building, Atlanta, Georgia.

Atlantic Refining Company, The, J. W. Van Dyke, president; W. P. Cutler, vice-president; W. M. Irish, secretary, and Henry S. Mustin, treasurer, 3144 Passyunk Avenue, Philadelphia, Pa.

Atlantic Westrumite Company, Inc., J. H. Cranford, president; R. Y. Filbert, vice-president; A. H. Putnam, secretary and treasurer, 2620 E Street N.W., Washington, D. C.

Attica Bridge Company, Attica, Indiana.

R. D. Baker Company (expansion joints), R. D. Baker, president, 73 Home Bank Building. Detroit, Michigan (advertisement page 144).

Barber Asphalt Paving Company, Charles W. Bayliss, manager road department, Land Title Building, Philadelphia, Pennsylvania (advertisement page 145).

Barrett Manufacturing Company,'F. S. Hutchinson, manager Tarvia department, 17 Battery Place, New York, New York (advertisement page 147).

Bausch and Lomb Optical Company (instruments), Rochester, New York (advertisement page 140).

Baker and Lockwood Manufacturing Company (tents), Kansas City, Missouri.

The L. Beckmann Company (surveyors' instruments), 600 Adams Street, Toledo, Ohio.

Beecher Draft Spring Company, New Haven, Connecticut.

C. L. Berger and Sons (surveyors' instruments), 37 Williams Street, Boston, Massachusetts.

The Binder Company (road oils), John H. Hurlbutt, president, 82 Beaver Street, New York, New York.

Birdsboro Stone Company, Chas. A. Bergdoll, president; Robt. MacBurney, general manager; E. C. Bergdoll, treasurer; Albert T. Hall, secretary, 614 Bulletin Building, Philadelphia, Pennsylvania.

Birmingham Rail and Locomotive Company (locomotives and steam shovels), Birmingham, Alabama.

Bituminised Road Company (pavement manufacturer), Reliance Building, Kansas City, Missouri.

Bituminous Products Company ("Besco" expansion joint), 378 Woodward Avenue, Detroit, Michigan.

Rudolph S. Blome Company (paving block), Rudolph S. Blome, president; City Hall Square Building, Chicago, Illinois.

Braden Culvert Company, Terre Haute, Indiana.

F. E. Brandis Sons Company (surveyors' instruments), 610–614 Gates Avenue, Brooklyn, New York.

The British American Oil Company, Ltd., S. R. Parsons, president, Toronto, Ontario, Canada.

Buff and Buff Manufacturing Company (surveyors' instruments), Jamaica Plains, Massachusetts.

Edward E. Buhler Company (supplies), Edward E. Buhler, president and general manager, 103 Park Avenue, New York City.

Burton Powder Company, J. Burton, president, Pittsburgh, Pennsylvania.

Butler Manufacturing Company (culverts), Chas. R. Butler, president; John D. Stevens, secretary and treasurer; E. E. Norquist, superintendent, Minneapolis, Minnesota.

Byerley and Sons (road oils), Frank A. Byerley, Cleveland, Ohio.

Cannelton Sewer Pipe Company, H. H. Clemens, secretary, Cannelton, Indiana.

The Philip Carey Company (expansion joints), George D. Crabbs, president; R. B. Crabbs, vice-president; E. L. Buse, secretary, Cincinnati, Ohio.

Carnegie Steel Company (crushed slag and bridge steel), Pittsburgh, Pennsylvania.

Champion Bridge Company, Wilmington, Ohio.

Chicago Steel Tape Company, L. A. Nichols, president, 6229–6233 Cottage Grove Avenue, Chicago, Illinois (advertisement page 152).

The Cleveland Stone Company, Cleveland, Ohio.

Clip-Bar Manufacturing Company (curb guard), Philadelphia, Pennsylvania.

J. B. Clow and Sons (cast iron culvert pipe), Chicago, Illinois (advertisement page 193).

Geo. S. Comstock, Mechanicsburg, Pennsylvania.

Concrete Guard Rail Company, J. Y. McClintock, manager, Rochester, New York.

The Conneaut Shovel Company, G. W. Benton, secretary, Conneaut, Ohio.

Consolidated Metal Expanded Company (reinforcement bars), Park Avenue and 40th Street, New York City.

The Continental Bitumen Company, Toledo, Ohio.

Continental Bridge Company, Chicago, Illinois.

Corrugated Bar Company, Mutual Life Building, Buffalo, New York.

Creosoted Wood Block Paving Company, Charles S. Wadsworth, president, New Orleans, Louisiana.

F. D. Cummer and Sons Company, Cleveland. Ohio.

Cyclone Drill Company, Orrville, Ohio.

Detroit Gaphite Company (bridge paint), 10 Twelfth Street, Detroit, Michigan.

Eugene Dietzen Company (surveyor's instruments), 214–220 East 23d Street, New York City.

Donaldson Iron Company, Emaus, Pennsylvania (advertisement page 193).

E. I. du Pont de Nemours Powder Company, Wilmington, Delaware.

The Dustoline for Roads Company, Jno. S. Lamson, Jr., president; Edwin R. Lamson, vice-president; W. J. Lamson, treasurer; Fred L. LaRowe, secretary, Summit, New Jersey.

The Equitable Asphalt Maintenance Company, F. H. Moore, secretary-treasurer, Commerce Building, Kansas City, Missouri.

C. L. Farnsworth Company (engineering instruments), 23 Central Street, Boston, Massachusetts.

Farris Bridge Company, William Farris, president, Jenkins Arcade Building, Pittsburgh, Pennsylvania.

W. H. Filer Company (sign boards), 337 Jackson Street, Grove City, Pennsylvania.

The France Stone Company, L. H. Hawblits, Ohio Building, Toledo, Ohio.

Louis Frey and Company (surveyors' instruments), A. H. Honaker, manager, 116 Williams Street, New York, New York.

Fibred-Asphalt Company, George A. Henderson, St. Albans, West Virginia.

Gilsonite Construction Company, 721 Wainwright Building, St. Louis, Missouri.

Glamorgan Pipe and Foundry Company (cast iron culvert pipe), Lynchburg, Virginia (advertisement page 193).

The Glidden Varnish Company, Cleveland, Ohio (advertisement page 219).

W. and L. E. Gurley (surveyors' instruments), Troy, New York (advertisement page 155).

Harry Brothers Company (metal culverts), Newport, Kentucky.

O. K. Harry Steel Company, 2340–42 Papin Street, St. Louis, Missouri.

Hartford Paving and Construction Company (culverts), Hartford, Connecticut.

The Hastings Pavement Company, E. J. Morrison, president and general manager; O. A. Palmer, treasurer; C. P. Pultz, secretary, 25 Broad Street, Broad-Exchange Building, New York, New York (advertisement page 158).

Hassam Paving Company, Matthew J. Whittall, president; Harold Parker, vice-president; Alfred Thomas, treasurer; Walter E. Hassam, general manager, Slater Building, Worcester, Massachusetts (advertisement page 155).

Headley Good Roads Company (road oils), W. T. Headley, president; 30th and Spruce Streets, Philadelphia, Pennsylvania.

The Hennepin Bridge Company, Minneapolis, Minnesota.

Charles M. Higgins and Company (copying ink), Brooklyn, New York.

The Highway Culvert Form Company, 100–2 Madison Street, Ottawa, Illinois.

Hotchkiss Lock Metal Form Company, M. S. Hotchkiss, president, Binghamton, New York.

Impervious Product Company, Thos. J. McDonald, president, Baltimore, Maryland.

Independent Powder Company of Missouri, N. P. Rood, president, Joplin, Missouri.

The Indestructible Sign Company, Columbus, Ohio.

Indian Refining Company, Inc., 17 Battery Place, New York, New York.

International Asphalt Company, Chamber of Commerce Building, Chicago, Illinois.

Jennison-Wright Company, Toledo, Ohio (advertisement page 165).

Kalamazoo Foundry and Machine Company (culverts), Kalamazoo, Michigan.

Kentucky Culvert Company, Chas. J. Fegenbush, general manager, Buechel, Kentucky.

Keystone National Powder Company, Emporium, Pennsylvania.

Kueffel and Esser (surveyors' instruments), Hoboken, New Jersey.

Ledder and Probst (surveyors' instruments), Boston, Massachusetts.

F. J. Lewis Manufacturing Company (road oils), Moline, Illinois.

Lock Joint Pipe Company, A. M. Hirsh, treasurer, Ampere, New Jersey.

The Lufkin Rule Company, A. M. Marshall, president, Saginaw, Michigan.

Lynchburg Foundry Company (cast iron culvert pipe), Lynchburg, Virginia (advertisement page 193).

Marsh Engineering Company (bridge builders), Des Moines, Iowa.

Massillon Iron and Steel Company, Massillon, Ohio (advertisement page 193).

Memphis Bridge Company, Memphis, Tennessee.

Memphis Stone and Gravel Company, Memphis, Tennessee.

Merrillat Culvert Core Company (culvert forms), C. C. Merrillat, general manager, Winfield, Iowa.

The Midland Bridge Company, 504–10 Midland Building, Kansas City, Missouri.

Morrison Tent and Awning Company, 115-17 Olive Street, St. Louis, Missouri.

National Concrete Company, 805 Traction Terminal Building, Indianapolis, Indiana.

The National Safety Wood Paving Company, James A. Cogswell, president, 1520 Real Estate Trust Building, Philadelphia, Pennsylvania.

National Tracing Cloth Company, Saylesville, Rhode Island.

National Tube Company, Wm. B. Schiller, president, Pittsburgh, Pennsylvania.

The Neuchatel Asphalt Company, Ltd., Wm. K. Bonfield, sales manager, 291 Broadway, New York City.

Newport Rolling Mill Company, Frank A. Moesch, sales manager, Newport, Kentucky.

Northfield Iron Company, 422 Water Street, Northfield, Minnesota.

North Western Expanded Metal Company (reinforcement bars), Old Colony Building, Chicago, Illinois.

Orenstein-Arthur Koppel Company (dump cars), 30 Church Street, New York, New York (advertisement page 179).

C. F. Pease Company (blue prints), 166 West Adams Street, Chicago, Illinois.

The Pennsylvania Steel Company, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.

Pennsylvania Trojan Powder Company, Allentown, Pennsylvania.

The Petroleum Iron Works Company, Sharon, Pennsylvania.

The Portage Silica Company, J. G. Butler, Jr., president; E. E. Kloos, secretary and general manager; H. Z. Kelly, treasurer, 501 Stambaugh Building, Youngstown, Ohio (advertisement page 179).

Portsmouth Steel Company, T. H. Jones, secretary, Portsmouth, Ohio (advertisement page 196).

Quick Unloading Car Chute Company, 807 Title Building, Birmingham, Alabama.

Republic Creosoting Company, George W. Warmoth, Indianapolis, Indiana.

Roanoke Bridge Company, Inc., Roanoke, Virginia.

Robeson Process Company, J. S. Robeson, president, Pennington, New Jersey (advertisement page 172).

Rock Island Bridge and Iron Works, Rock Island, Illinois.

Rosing, Astrid S. (clay products), Harris Trust Building, Chicago, Illinois.

E. G. Ruehle (surveyors' instruments), 119 Fulton Street, New York City.

Salfisberg, J. E. and Company (engineering instruments), Aurora, Illinois.

R. Seelig and Sons (engineering instruments), 329 North Fifth Avenue, Chicago, Illinois.

The Shannon Self-Locking Metal Culvert, George G. McGlaughlin, Cincinnati, Ohio.

Shelby Downward Asphalt Company, Ardmore, Oklahoma.

Sicilian Asphalt Paving Company, Howard Carroll, president; Harry Haggerty, secretary; George C. Clausen, treasurer, 41 Park Row and 12th Avenue and 54th Street, New York City.

E. G. Soltman (surveyors' instruments), 134 West 29th street, New York City.

Solvay Process Company, Fredk. R. Hasard, president; Rowland G. Hasard, vice-president; L. O. MacDaniel, treasurer; Geo. E. Francis, secretary, Syracuse, New York.

Southern Wood Preserving Company, R. H. White, president, Atlanta, Georgia.

Standard Asphalt and Rubber Company, E. G. Lessynsky, president, 137 North LaSalle Street, Chicago, Illinois (advertisement page 175).

Standard Cast Iron Pipe Company, Bristol, Pennsylvania (advertisement page 193).

Standard Oil Company of New York, 26 Broadway, New York City (advertisement page 178).

Standard Oil Company of New Jersey, 26 Broadway, New York City (advertisement page 176).

Stark, N. M. and Company (bridge builders), Des Moines, Iowa.

Steel Protected Concrete Company, H. A. Miner, president, Real Estate Trust Building, Philadelphia, Pennsylvania (advertisement page 179).

Sun Company, J. N. Pew, Jr., president, 1421 Chestnut Street, Morris Building, Philadelphia, Pennsylvania.

Sweeney and Gray (road supplies), J. A. Gray, manager, 61 Sixth Street, Long Island City, New York.

Texas Company, W. H. Kershaw, sales manager, Whitehall Building, New York City (advertisement page 180).

Traub and Helfrecht (culvert), Germania, Pennsylvania.

Trussed Concrete Steel Company, Detroit, Michigan (advertisement page 181).

Universal Drafting Machine Company, Cleveland, Ohio.

Union Oil Company of California, Wm. L. Soleau, comptroller; Alexander Sclater, manager, sales department, Union Oil Building, Los Angeles, California (advertisement page 182).

Union Paving Company, B. F. Richardson, vice-president, Fidelity Mutual Life Building, Philadelphia, Pennsylvania.

U. S. Asphalt Refining Company, O. E. Thurber, vice-president; Geo. L. Whitney, secretary; Jos. R. Draney, sales manager, 90 West Street, New York City (advertisement page 184).

U. S. Cast Iron Pipe and Foundry Company, L. R. Lemoine, president; Geo. J. Long, vice-president; B. F. Haughton, secretary and treasurer, Morris Building, Philadelphia, Pennsylvania (advertisement page 196).

U. S. Wood Preserving Company, 165 Broadway, New York City (advertisement page 183).

The United Gas Improvement Company, Samuel T. Bodine, president; Paul Thompson, vice-president; Walter H. Fulweiler, manager, road department, Philadelphia, Pennsylvania.

The Wadsworth Stone and Paving Company. W. C. Thoma, president and general manager; J. A. Siedle, secretary and treasurer, Lambert Street and Pennsylvania Railroad, Pittsburgh, Pennsylvania (advertisement page 188).

Waring-Underwood Company (Ideal expansion joint), Commercial Trust Building, Philadelphia, Pennsylvania.

Warner-Quinlan Asphalt Company, A. R. Knight, sales manager, 7 Wall Street, New York.

Warren Brothers Company, George C. Warren, president and general manager; Chas. W. Young, vice-president; Ralph H. Warren, treasurer; Albert C. Warren, secretary, 59 Temple Place, Boston, Massachusetts (advertisement page 189).

Washington Block and Asphalt Tile Company, R. H. Johnson, president, Washington, D. C.

Wern Machinery and Engineering Company (granite blocks), 30 Church Street, New York City.

Western Bridge and Construction Company, Bee Building, Omaha, Nebraska.

Westrumite Company, The, J. A. Gill, president; G. S. van Westrum, vice-president; J. H. Fowler, secretary; F. J. Smith, treasurer, all at Whiting, Indiana (advertisement page 190).

R. D. Wood and Company (cast iron culvert pipe), Philadelphia, Pennsylvania (advertisement page 193).

The Wycoff Pipe and Creosoting Company, 48 Church Street, New York City.

York Bridge Company, York, Pennsylvania.

Young and Sons (engineering instruments), Philadelphia, Pennsylvania.

Dealers in or Agents for Road Making Machinery and Material

Albany Hardware and Specialty Manufacturing Company, Albany, Wisconsin.

Bacon, Edward R. (contractors equipment), 38–40 Natoma Street, San Francisco, California.

Baker Jr., John (oils), Roanoke Building, Chicago, Illinois.

James S. Barron, 127 Franklin Street, New York City.

C. N. Carpenter Supply Company (grader, scraper, spreader and leveler), Canton, Ohio.

Chamberlin, A. B. (oils), 7 East 42nd Street, New York City.

Good Roads Supply Company, Horatio S. Earle, president; Earl I. Heenan, vice-president; L. J. Brown, secretary and treasurer; Ford Building, Detroit Michigan.

Haines and Teall, United States Agents for "ROCMAC," LaFayette Building, Philadelphia, Pa. (advertisement page 173).

Harold L. Bond Company, of New York, Harold L. Bond, president; Howard C. Weaver, secretary-treasurer; Geo. S. Hedge, vice-president; 78-80 Bridge Street, New York City.

Henry J. McCoy Company, Henry J. McCoy, president; Jas. W. McCoy, vice-president; John G. Wentink, treasurer; Frank E. Hall, secretary, 65 Dey Street, New York City.

The Good Roads Machinery Company, Kennett Square, Pennsylvania.

Lima Contractors Supply Company, Delphos, Ohio.

Geo. E. Ritchey Supply Company, Columbus, Ohio.

Road Supply and Metal Company, F. L. Carswell, secretary, Topeka, Kansas.

Thos. M. Roche, Monadnock Building, Chicago, Illinois (advertisement page 185).

George T. Wallace Sales Company, 301 Penobscot Building, Detroit, Michigan.

Association of American Portland Cement Manufacturers

Officers.—John B. Lober, president, president Vulcanite Portland Cement Company, Land Title Building, Philadelphia, Pa.; Robest S. Sinclair, vice-president, vice-president Alsen's American Portland Cement Works, 45 Broadway, New York City; Chas. F. Conn, treasurer, president Giant Portland Cement Co., 604 Pennsylvania Building, Philadelphia, Pa.; Percy H. Wilson, secretary, 1526 Land Title Building, Philadelphia, Pa.

Headquarters.—1526 Land Title Building, Philadelphia, Pennsylvania.

Objects.—To acquire and disseminate information concerning the best practice in the use of cement and concrete.

To raise the standards of construction.

To emphasize the necessity of careful attention to all details of construction and to the selection of such materials as will produce the best results.

To give to anyone requesting same, information they may desire on the proper use of cement and concrete.

Portland Cement Manufacturers

Allentown Portland Cement Company, Allentown, Pennsylvania.
Alpha Portland Cement Company, Easton, Pennsylvania.
Alsen's American Portland Cement Works, 45 Broadway, New York City.
Ash Grove Lime and Portland Cement Company, R. A. Long Building, Kansas City, Missouri.
Atlantic and Gulf Portland Cement Company, Ragland, Alabama.
Atlas Portland Cement Company, 30 Broad Street, New York City, New York.
Bath Portland Cement Company, Newark, New Jersey.
Castalia Portland Cement Company, Publication Building, Pittsburgh, Pennsylvania.
Cayuga Lake Cement Company, Ithaca, New York.
Chicago Portland Cement Company, 30 N. LaSalle Street, Chicago, Illinois.
Clinchfield Portland Cement Corporation, Kingsport, Tennessee.
Colorado Portland Cement Company, Denver, Colorado.
Continental Portland Cement Company, St. Louis, Missouri.
Coplay Cement Manufacturing Company, Land Title Building, Philadelphia, Pennsylvania.
Crescent Portland Cement Company, Wampum, Pennsylvania.
Dewey Portland Cement Company, Scarritt Building, Kansas City, Missouri.
Dexter Portland Cement Company, Nazareth, Pennsylvania.
Diamond Portland Cement Company, Williamson Building, Cleveland, Ohio.
Dixie Portland Cement Company, Chattanooga, Tennessee.
Edison Portland Cement Company, Stewartsville, New Jersey.
German-American Portland Cement Works, La Salle, Illinois.
Giant Portland Cement Company, 604 Pennsylvania Building, Philadelphia, Pennsylvania.
Glens Falls Portland Cement Company, Glens Falls, New York.
Helderberg Cement Company, Albany, New York.
Huron Portland Cement Company, Ford Building, Detroit, Michigan.
Iola Portland Cement Company, Iola, Kansas.
Iowa Portland Cement Company, Des Moines, Iowa.
Kosmos Portland Cement Company, Kosmosdale, Kentucky.
Lehigh Portland Cement Company, Allentown, Pennsylvania.
Louisville Cement Company, Louisville, Kentucky.
Michigan Portland Cement Company, Chelsea, Michigan.
Nazareth Cement Company, Nazareth, Pennsylvania.
New Aetna Portland Cement Company, Detroit, Michigan.
Newaygo Portland Cement Company, Grand Rapids, Michigan.
Northwestern States Portland Cement Company, Mason City, Iowa.
Ogden Portland Cement Company, Ogden, Utah.
Oklahoma Portland Cement Company, Ada, Oklahoma.
Peerless Portland Cement Company, Union City, Michigan.
Peninsular Portland Cement Company, Jackson, Michigan.
Penn-Allen Cement Company, Allentown, Pennsylvania.

Pennsylvania Cement Company, 29 Broadway, New York City, New York.
Phoenix Portland Cement Company, Nazareth, Pennsylvania.
Portland Cement Company of Utah, Salt Lake City, Utah.
Riverside Portland Cement Company, Los Angeles, California.
San Antonio Portland Cement Company, San Antonio, Texas.
Security Cement and Lime Company, Baltimore, Maryland.
Southwestern Portland Cement Company, El Paso, Texas.
Southwestern States Portland Cement Company, Dallas, Texas.
Standard Portland Cement Company, Charleston, South Carolina.
Standard Portland Cement Corporation, San Francisco, California.
The Superior Portland Cement Company, Cincinnati, Ohio.
Texas Portland Cement Company, Cement, Texas.
Tidewater Portland Cement Company, Baltimore, Maryland.
Union Sand and Material Company, Liggett Building, St. Louis, Missouri.
United Kansas Portland Cement Company, Iola, Kansas.
United States Portland Cement Company, Denver, Colorado.
Universal Portland Cement Company, 72 West Adams Street, Chicago, Illinois.
Virginia Portland Cement Company, 26 Beaver Street, New York City, New York.
Vulcanite Portland Cement Company, Land Title Building, Philadelphia, Pennsylvania.
Wabash Portland Cement Company, Ford Building, Detroit, Michigan.
Whitehall Cement Manufacturing Company, Land Title Building, Philadelphia, Pennsylvania.
Wolverine Portland Cement Company, Coldwater, Michigan.

Foreign Member

Canada Cement Company, Limited, Montreal, Canada.

National Paving Brick Manufacturers Association

Officers.—Charles J. Deckman, president, Cleveland, Ohio; J. W. Robb, vice-president, Clinton, Indiana; C. C. Barr, treasurer, Streator, Illinois; Will P. Blair, secretary, Cleveland, Ohio; H. H. MacDonald, assistant secretary, Cleveland, Ohio.

Purposes.—The National Paving Brick Manufacturers Association of this country was organised for the following purposes:

1. A dissemination among its membership of technical knowledge relating to the manufacture of their product.
2. To bring to the attention of the public the merits of Vitrified Brick as a paving material.
3. To influence to the greatest possible extent the proper construction of brick streets.
4. For furnishing truthful and reliable information regarding other paving materials, and their comparative value as pavements when considered with brick pavements.

Paving Brick Manufacturers

Alliance Clay Product Company, J. B. Wilcox, Alliance, Ohio.
Alton Brick Company, Eben Rodgers, Alton, Illinois.
American Sewer Pipe Company, A. S. McComb, Akron, Ohio.

Ashtabula Shale Brick Company, N. C. Ralph, Ashtabula, Ohio.
Athens Brick Company, W. N. Alderman, Athens, Ohio.
Barr Clay Company, The, C. C. Barr, Streator, Illinois.
Bessemer Limestone Company, C. C. Blair, Youngstown, Ohio.
Big Four Clay Company, G. O. French, Canton, Ohio.
Boone Brick, Tile and Paving Company, W. H. Brecht, Boone, Iowa.
Cleveland Brick and Clay Company, F. M. Brady, Cleveland, Ohio.
Cleveland Vitrified Brick Company, E. B. Wentworth, Oklahoma City, Oklahoma.
Clinton Paving Brick Company, J. W. Robb, Clinton, Indiana.
Corry Brick and Tile Company, D. Warren De Rosay, Corry, Pennsylvania.
Danville Brick Company, W. P. Whitney, Danville, Illinois.
Deckman-Duty Brick Company, C. J. Deckman, S. M. Duty, Cleveland, Ohio.
Denny-Renton Clay and Coal Company, Seattle, Washington.
Foster, C. E., Attica, Indiana.
Hammond Fire Brick Company, T. I. Brett, Fairmont, West Virginia.
Hocking Valley Brick Company, L. J. Murphy, Nelsonville, Ohio.
Kline Brick Company, John, John Kline, Wickliffe, Ohio.
Kushequa Brick Company, E. K. Kane, Kushequa, Pennsylvania.
McAvoy Vitrified Brick Company, 1345 Arch Street, Philadelphia, Pennsylvania.
Marion Brick Works, Montezuma, Indiana.
Mayer Brick Company, C. P., C. P. Mayor, Bridgeville, Pennsylvania.
Medora Shale Brick Company, C. C. McMillan, Medora, Indiana.
Metropolitan Paving Brick Company, J. G. Barbour, Canton, Ohio.
Nelsonville Brick Company, C. H. Doan, Nelsonville, Ohio.
Newburgh Brick and Clay Company, J. R. Zmunt, Cleveland, Ohio.
Novelty Brick and Coal Company, Newcomerstown, Ohio.
Peebles Paving Brick Company, F. L. Manning, Portsmouth, Ohio.
Poston Paving Brick Company, J. M. Waugh, Crawfordsville, Indiana.
Scioto Fire Brick Company, C. W. Turner, Sciotoville, Ohio.
Sharon Clay Products Company, W. C. Taylor, Sharon, Pennsylvania.
Shawmut Paving Brick Company, Alfred Yates, Shawmut, Pennsylvania.
Smith, Company, A. F., P. A. Smith, New Brighton, Pennsylvania.
Soisson, Fire Brick Company, Jos., Bolivar, Pennsylvania.
South Zanesville Sewer Pipe and Brick Company, J. C. Bolen, Jr., Zanesville, Ohio.
Springfield Paving Brick Company, Springfield, Illinois.
Stipp, Peter, successor to Scranton Vitrified Brick Company, Scranton, Pennsylvania.
Streator Paving Brick Company, E. F. Plumb, Streator, Illinois.
Terre Haute Vitrified Brick Company, J. M. Hoskins, Terre Haute, Indiana.
Thorton Fire Brick Company, D. R. Potter, Clarksburg, West Virginia.
Townsend Brick and Contracting Company, T. B., O. N. Townsend, Zanesville, Ohio.
Trimble Brick Manufacturing Company, J. H. Simpson, Dayton, Ohio.
United Brick Company, G. H. Francis, Greensburg, Pennsylvania.
Wabash Clay Company, Veedersburg, Indiana.
Wassall Brick Company, R. L. Lewis, Gloucester, Ohio.
Western Clay Manufacturing Company, C. H. Bray, Helena, Montana.
Westport Paving Brick Company, John W. Hall, Baltimore, Maryland.
Windsor Brick Company, J. T. Windsor, Akron, Ohio.
Wooster Shale Brick Company, W. R. Barnhardt, Jr., Wooster, Ohio.

Adamantine Clay Products Company, North Mountain, West Virginia.
Albion Vitrified Brick Company, Albion, Illinois.
Allentown Paving Brick Company, Allentown, Pennsylvania.
Alliance Brick Company, Alliance, Ohio.
Atchison Paving Brick Company, Atchison, Kansas.
Banner Clay Works, Edwardsville, Illinois.
Barber Asphalt Paving Company, Des Moines, Iowa.
Binghamton Paving Block Company, Binghamton, New York.
Bloomfield Brick Company, Bloomfield, Indiana.
Brick, Terra Cotta and Tile Company, Corning, N. Y.
Buffalo Brick Company, Buffalo, Kansas.
Burke Brothers Brick Company, Fort Smith, Arkansas.
Carlyle Paving Brick Company, Portsmouth, Ohio.
Clearfield Brick Manufacturing Company, Clearfield, Pennsylvania.
Clearfield Clay Working Company, Clearfield, Pennsylvania.
Clymer Brick Company, Clymer, Pennsylvania.
Coffeyville Shale Brick Company, Coffeyville, Kansas.
Coffeyville Vitrified Brick and Tile Company, Coffeyville, Kansas.
Copeland-Inglis Shale Brick Company, Birmingham, Alabama.
Detroit Vitrified Brick Company, Detroit, Michigan.
Du Bois-Butler Brick Company, Du Bois, Pennsylvania.
Flint Brick and Coal Company, Des Moines, Iowa.
Foster Sales Company, Bradford, Pennsylvania.
Freeport Clay Products Company, Freeport, Pennsylvania.
Fultonham Brick Company, East Fultonham, Ohio.
Georgia Vitrified Brick and Clay Company, Augusta, Georgia.
Glen-Gery Brick and Cement Company, Reading, Pennsylvania.
Gloninger and Maxwell, Pittsburgh, Pennsylvania.
Graves Shale Paving Brick Company, Birmingham, Alabama.
Hankinson and Hagler, Augusta, Georgia.
Harris Brick Company, Cincinnati, Ohio.
Hydraulic Pressed Brick Company, St. Louis, Missouri.
Independence Brick Company, Independence, Kansas.
Indiana Paving Brick and Block Company, Indianapolis, Indiana.
Jamestown Paving Brick Company, Jamestown, New York.
Kelly Brick Company, Wm. P. Winder, Pennsylvania.
Layton Fire Clay Company, McKeesport, Pennsylvania.
Los Angeles Pressed Brick Company, Los Angeles, California.
Mack Manufacturing Company, Philadelphia, Pennsylvania.
Martinsville Brick Company, Martinsville, Indiana.
Massillon Brick Company, Massillon, Ohio.
Michigan Vitrified Brick Company, Bay City, Michigan.
Murphysboro Paving Brick Company, E. St. Louis, Illinois.
New Era Vitrified Brick Company, Bay City, Michigan.
New Hope Vitrified Brick Company, New Hope, Pennsylvania.
Noble Brick Company, Glenwood, Ohio.
Oakland Paving Brick Company, Decota, California.
Patten Clay Company, Patten, Pennsylvania.
Patterson Clay Products Company, Clearfield, Pennsylvania.
Pennsylvania Clay Company, Pittsburgh, Pennsylvania.
Pittsburgh Vitrified Paving and Building Brick Company, Kansas City, Missouri.
Portsmouth Granite Brick Company, Firebrick, Kentucky.
Puritan Brick Company, Hamden, Ohio.
Purington Paving Brick Company, Galesburg, Illinois.

Reynoldsville Brick and Tile Company, Reynoldsville, Pennsylvania.
Saginaw Paving Brick Company, Saginaw, Michigan.
Southern Clay Manufacturing Company, Chattanooga, Tennessee.
South Webster Brick and Tile Company, South Webster, Ohio.
Standard Clay Company, Tacoma, Washington.
Standard Shale Company, Youngsville, Pennsylvania.
Standard Vitrified Brick Company, Coffeyville, Kansas.
Sterling Brick Company, Olean, New York.
Suburban Brick Company, Moundsville, West Virginia.
Thurber Brick Company, Thurber, Texas.
Tidewater Paving Brick Company, Catskill, New York.
Toronto Fire Clay Company, Toronto, Ohio.
Tulsa Brick Company, Tulsa, Oklahoma.
Tuna Valley Pressed Brick Company, Bradford, Pennsylvania.
United Fire Brick Company, Uniontown, Pennsylvania.
Vinton Brick Company, Dayton, Ohio.
Vulcan Brick Company, Wellsville, Ohio.
Watsontown Brick and Clay Products Company, Watsontown, Pennsylvania.
Windsor Brick and Tile Company, Sedalia, Missouri.
Youngsville Brick and Tile Company, Bradford, Pennsylvania.

Wood Block Paving Manufacturers

American Creosoting Company, Marion, Illinois.
American Creosoting Company, Newark, New Jersey.
Ayer and Lord Tie Company, Argenta, Arkansas.
Ayer and Lord Tie Company, Carbondale, Illinois.
Ayer and Lord Tie Company, Grenada, Mississippi.
Barber Asphalt Paving Company, Maurer, New Jersey.
Chicago Creosoting Company, Chicago, Illinois.
Colman Creosoting Company, Seattle, Washington.
Compressed Wood Preserving Company, The, Cincinnati, Ohio.
Creosoted Wood Block Paving Company, New Orleans, Louisiana.
Eppinger and Russell Company, Long Island City, New York.
Gulfport Creosoting Company, Gulfport, Mississippi.
International Creosote and Construction Company, Beaumont, Texas.
International Creosote and Construction Company, Texarkana, Texas.
Jennison Wright Company, Toledo, Ohio.
Kettle River Company, The, Madison, Illinois.
Kettle River Company, The, Sandstone, Minn.
National Lumber and Creosoting Company, Texarkana, Arkansas.
New Orleans Wood Preserving Company, New Orleans, Louisiana.
Pacific Creosoting Company, Eagle Harbor, Washington.
Puget Sound Wood Preserving Company, Lowell, Washington.
Republic Creosoting Company, Mobile, Alabama.
Republic Creosoting Company, Indianapolis, Indiana.
Republic Creosoting Company, Minneapolis, Minnesota.
St. Paul and Tacoma Lumber Company, Tacoma, Washington.
Shreveport Creosoting Company, Shreveport, Louisiana.
Southern Creosote Company, Ltd., Slidell, Louisiana.
Southern Wood Preserving Company, Atlanta, Georgia.
U. S. Wood Preserving Company, Norfolk, Virginia.
Wyckoff Pipe Creosoting Company, Portsmouth, Virginia.

American Concrete Institute

Officers.—Richard L. Humphrey, Philadelphia, Pennsylvania, president; Arthur N. Talbot, Urbana, Illinois, vice-president; L. C. Wason, Boston, Massachusetts, vice-president; Robert A. Cummings, Pittsburgh, Pennsylvania, treasurer; Edw. E. Krauss, Philadelphia, Pennsylvania, secretary.

Directors.—First District, W. L. Church, Boston, Massachusetts; Second District, E. D. Boyer, New York, New York; Third District, Robert W. Lesley, Philadelphia, Pennsylvania; Fourth District, W. P. Anderson, Cincinnati, Ohio; Fifth District, B. F. Affleck, Chicago, Illinois; Sixth District, John B. Leonard, San Francisco, California.

National Lime Manufacturers Association

Officers.—William E. Carson, president, Riverton, Virginia; Martin Deeley, first vice-president, Lee, Massachusetts; J. F. Pollock, second vice-president, Kansas City, Missouri; Bernard L. McNulty, third vice-president, Anniston, Alabama; Fred K. Irvine, secretary, Chicago, Illinois; C. W. S. Cobb, treasurer, St. Louis, Missouri.

Executive Committee.—W. E. Carson, chairman, ex-officio; Charles Warner, Wilmington, Delaware; Lawrence Hitchcock, Cleveland, Ohio; H. S. Gray, Louisville, Kentucky.

National Association of Sand and Gravel Producers

Officers.—F. W. Renwick, Chicago Gravel Company, 343 S. Dearborn Street, Chicago, Illinois, president; H. H. Halliday, Halliday Sand Company, Cairo, Illinois, first vice-president; W. F. Bradley, Ohio and Michigan Sand and Gravel Company, Toledo, Ohio, second vice-president; H. F. Curtis, Lyman Sand Company, Omaha, Nebraska, third vice-president; Lee R. Witty, Wabash Sand and Gravel Company, Terre Haute, Indiana, fourth vice-president; C. H. Brand, Atwood-Davis Sand Company, Chicago, Illinois, treasurer.

AMERICAN HIGHWAY ASSOCIATION

The American Highway Association was organized at Washington, D. C., November 22, 1910.

Its purposes are:

To correlate and harmonize the efforts of all existing organizations working for road improvement.

To arouse and stimulate sentiment for road improvement.

To strive for wise, equitable and uniform road legislation in every State.

To aid in bringing about efficient road administration in the States and their subdivisions, involving the introduction of skilled supervision and the elimination of politics from the management of the public roads.

To seek continuous and systematic maintenance of all roads, the classification of all roads according to traffic requirements, payment of road taxes in cash, and adoption of the principle of State aid and State supervision.

To advocate the correlation of all road construction so that the important roads of each county shall connect with those of the adjoining counties and the important roads of each State shall connect with those of adjoining States.

To strive for the utilization of convict labor on works of public improvement, where that course is consistent with the local policy, so as to involve the least possible competition with free labor, the utmost public benefit, and a healthy moral and physical development of the convict. In many States these results can be attained by using the convicts on road work or the preparation of road materials.

Constitution

ARTICLE I

(as amended)

Name

SECTION 1. The name of this organization shall be THE AMERICAN HIGHWAY ASSOCIATION.

ARTICLE II

Object

SECTION 1. The object of this Association is to harmonize and correlate all efforts for the improvement of the public roads, to the end that adequate and efficient systems of road construction, administration, and maintenance may be adopted in all of the States.

ARTICLE III

Location

SECTION 1. The official headquarters of this Association shall be located and maintained in the city of Washington, D. C.

ARTICLE IV

Membership

SECTION 1. The regular membership of this Association shall be composed of all persons who shall sign the roll of membership at the time of organization, or make written application to the Secretary and pay annual dues for one year in advance, membership to begin with written acceptance by the Secretary.

SEC. 2. The associate membership shall consist of all members of State and other organizations for road improvement, coöperating with this Association, *provided*, that a roster of such membership shall be filed with the Secretary by said organization.

SEC. 3. The sustaining membership shall consist of all persons or organizations who shall sign the roll of sustaining membership at the organization of this Association, or make written application to the Secretary and pay annual dues for sustaining membership one year in advance, membership to begin as soon as written acceptance shall have been received from the Secretary.

ARTICLE V

Officers

SECTION 1. The officers of this Association shall consist of a President, a Vice-President, a Treasurer, a Secretary, an Organizer, and a Board of Directors, to consist of the President and Vice-President of the Association and 23 additional members.

SEC. 2. The officers of the Association and the members of the Board of Directors shall be regular or sustaining members of the Association, and shall be elected at the first regular meeting and annually thereafter, except that the members of the Board, exclusive of the officers, shall be elected in three groups, the first to hold office for a period of three years, the second to hold office for a period of two years, and the third to hold office for a period of one year, vacancies on the Board to be filled annually thereafter.

ARTICLE VI

Committees

SECTION 1. There shall be four standing committees of this Association: An Executive Committee, consisting of five members; a Finance Committee; a Committee on Membership, and an Auditing Committee, consisting of three members. The members of the Auditing Committee shall be selected by the President at the first annual meeting, and shall hold office until the next regular meeting of the Association. The members of the other three committees shall be selected by the Board of Directors, and shall hold office until the next regular meeting of the Association.

ARTICLE VII

Amendments

SECTION 1. This Constitution may be amended at any regular meeting of the Association by three-fourths of the qualified voters present, *provided*, that the Secretary shall notify members of the Association of said regular meeting.

ARTICLE VIII

By-Laws

SECTION 1. The Board of Directors shall make such By-Laws for the government of the Association as it may deem necessary, and which shall not conflict with the provisions of the Constitution, and may amend or alter the same.

By-Laws

ARTICLE I

Annual Dues

SECTION 1. The annual dues for regular members of the Association shall be $5, payable in advance. Annual dues for sustaining members shall be $100, payable in advance. Associate members shall not be required to pay annual dues to this Association.

ARTICLE II

Voting Privileges

SECTION 1. Regular members of the Association shall be entitled to participate in its proceedings, and vote upon all questions that may come before the Association. Associate members shall be entitled to participate in discussions of questions before the Association. Sustaining members shall be entitled to participate in discussions, and to vote upon questions before the Association.

ARTICLE III

Duties of Officers

SECTION 1. The President shall be the executive head of the Association He shall preside at all meetings of the Association, and shall appoint an Auditing Committee and all temporary committees.

SEC. 2. In the absence of the President the Vice-President shall act in his place and stead, *provided*, that in the absence of both the President and Vice-President the Executive Committee shall immediately elect one of its members to perform the duties of the President.

SEC. 3. The Secretary shall keep the records and minutes of the Association. He shall draw all orders upon the Treasurer for the payment of money. He shall serve all notices and perform all duties necessary to the proper conduct of the business affairs of the Association, and shall perform such additional duties as may be assigned to him by the Board of Directors. He shall make written report annually of the work of the Association, and shall make such special written reports to the Board of Directors as they may require from time to time.

SEC. 4. The Treasurer shall be the custodian of the funds of the Association. He shall pay all orders for money duly signed by the Secretary. He shall make a written report annually to the Association, accounting for all funds received and disbursed. If the Treasurer shall for good and sufficient reason be temporarily unable at any time to perform the duties of his office, he shall so inform the chairman of the Executive Committee, who shall, with the concurrence of two other members of said committee, designate one of their members to perform the duties of Treasurer, until such time as the Treasurer shall resume his duties and so inform the chairman of the Executive Committee.

SEC. 5. The Organizer shall perform such duties as are assigned to him by the Board of Directors.

SEC. 6. The Board of Directors shall at its first meeting and annually thereafter elect a chairman. The Board shall have custody of all property of the Association; shall have charge of the financial affairs of the Association; shall provide ways and means for its expenses, shall appoint all regular committees and all officers not otherwise provided for, shall have supervision and control over all work carried on by the Association and its officers, and shall fill all vacancies in its own membership and among the officers of the Association between the meetings of the Association.

ARTICLE IV

Duties of Committees

SECTION 1. The Executive Committee shall act for the Board of Directors and exercise all the powers of said Board in the interim between the meetings of said Board, and shall report quarterly to the Board the condition of the Association and its work.

SEC. 2. The Committee on Finance shall provide for the raising of funds to carry on the work of the Association and shall have supervision over the financial affairs of the Association.

SEC. 3. The Committee on Membership shall deal with all questions relating to membership in the Association, and shall take such steps as it may deem advisable for increasing the membership of the Association.

SEC. 4. The Auditing Committee shall audit and review the reports of the Secretary and the Treasurer.

ARTICLE V

Meetings

SECTION 1. Regular meetings of the Association shall be held annually at such time and place as the Board of Directors may determine. Special meetings may be called by the Board of Directors, or by two-thirds of the regular members of the Association.

SEC. 2. The Board of Directors may fix the time and place of its meetings, provided that it shall meet at least once in each year.

SEC. 3. The Executive Committee shall fix the time and place of its meetings, provided that it shall meet at least once in each three months.

ARTICLE VI

Quorums

SECTION 1. A quorum of the Association shall consist of fifty members who shall be present in person.

SEC. 2. A quorum of the Board of Directors shall consist of five members who shall be present in person.

SEC. 3. A quorum of the Executive Committee shall consist of a majority of its members.

ARTICLE VII

Amendments

SECTION. 1. The By-Laws of this Association may be altered or amended by the Board of Directors, at their discretion, *provided*, that such By-Laws shall not conflict with the provisions of the Constitution.

Working Plan

In addition to its volunteer non-paid workers, the Association has a small corps of thoroughly competent salaried men whose duties are: to appear before State legislative committees, on invitation, and give advice on pending road legislation; to address conventions and local meetings in advocacy of needed reforms in road improvement; to organize and prepare working plans for local road improvement associations; to prepare articles of educational and news value for the use of the press in arousing, stimulating and directing public sentiment.

The Association is continually assembling data concerning the progress and status of the road movement, embracing road legislation, bond issues, mileage and cost of roads, organization work, etc.

Annually the Association holds a Road Congress for the discussion of problems of road construction, maintenance and administration, and for correlation and coördination of the work conducted by the various State and Interstate road organizations.

The Association coöperates with railroad companies and the national government in educational campaigns through the medium of "Good Roads Trains." Under this plan the government provides a miniature working exhibit illustrating types of roads and methods of construction, a stereopticon with slides, and assigns one or more demonstrators to accompany the train at government expense for salary, travel and subsistence. The Association at its own expense provides an experienced organizer who organizes in each county traversed, a practical association and suggests a constitution and a working plan for it. The plan in general is as follows:

It is suggested that as soon as the organization has been completed, a constitution and by-laws adopted and permanent officers elected, working committees should be selected whose distribution of duties and responsibilities should be somewhat as follows:

(a) *Committee on Road Administration.*—This committee should ascertain the laws upon which the road administration of the county or locality are based, the personnel of the official organization selected to carry out such laws, the revenues available for road purposes, how obtained, how expended, and what system of accounting and recording is followed. It should recommend needed reforms in road laws, organization and administration; it should ascertain the various sources of revenue and plans for raising additional revenues; and should eventually formulate its findings into a report containing recommendations for the future financing of road work.

(b) *Committee on Road Materials.*—This committee should ascertain the location, character, quantity and availability of all road materials in the county. This work can be much facilitated by coöperation with the Office of Public Roads of the United States Department of Agriculture, which makes analyses and tests of road materials free of charge, whereby the kind and quality of road building material can be definitely ascertained. The committee should also make a study of transportation facilities for road materials, and work out plans whereby the county or locality can obtain the best materials in the easiest and most economical manner. They might consider the advisability of the purchase of quarries and gravel pits, the arrangement of special rates with the railroad companies, the preparation of the materials by county prisoners, etc.

(c) *Committee on Road Construction and Maintenance.*—This committee should ascertain the mileage of public roads, and classify them according to amount and importance of traffic, ascertaining the improvement that is necessary and the probable cost; draw up a general plan for the gradual improvement of all the county roads along definite, intelligent lines, according to the means available; obtain data bearing upon all phases of road construction; and should coöperate closely with the committee on road materials in drawing up its recommendations as to the kind and amount of road construction to be undertaken. It should make a close study of road maintenance, with a view to introducing the best and most economical methods for maintaining the roads. It should look into the relative merits of the various kinds of road equipment, and aid the county authorities by information and advice in securing the necessary equipment.

(d) *Committee on Earth Roads.*—This committee should devise ways and means for stimulating interest in the road drag, and should endeavor to bring about the general use of this simple little implement. Records could be kept of the number of drags in use, and the mileage of roads regularly dragged as the result of the work of the committee. Contests could be inaugurated and publicity given the work, so that the interest might become widespread, and practical results accomplished.

The Association plans to issue instructive publications from time to time, in addition to the Year Book, including the papers read and proceedings had at the Annual Road Congress.

The foregoing specific examples indicate *in part* the *methods* by which the Association is endeavoring to carry out its purposes. New methods and new lines of activity frequently develop and are utilized as far as practicable.

Officers

President

Mr. L. W. Page
Director, U. S. Office of Public Roads

Vice-President

Mr. Fairfax Harrison
President, Southern Railway Company

Secretary and Editor

Mr. J. E. Pennybacker, Jr.

Treasurer

Mr. Lee McClung
Former Treasurer of the United States

Chairman, Board of Directors

Mr. James S. Harlan
Chairman Inter-State Commerce Commission

Organizer and Field Secretary

Mr. Charles P. Light

Board of Directors

Terms expire 1914

A. G. Batchelder, American Automobile Association.
Philip T. Colgrove, president, Michigan State Good Roads Association.
John M. Goodell, former editor, *Engineering Record*.
Bryan Lathrop, member, Lincoln Park Commission.
Lee McClung, former treasurer of the United States.
Walter H. Page, ambassador to the Court of St. James.
Leonard Tufts, president, Capital Highway Association.
B. F. Yoakum, chairman, Frisco Lines.

Terms expire 1915

W. T. Beatty, Chicago, Illinois.
George W. Cooley, State highway engineer, St. Paul, Minnesota.
George C. Diehl, chairman, Good Roads Board, A.A.A.
Clarence A. Kenyon, former president, Indiana Good Roads Association.
James H. MacDonald, former State highway commissioner, Connecticut.
Dr. Joseph Hyde Pratt, State geologist of North Carolina.
Jesse Taylor, president, Ohio Good Roads Federation.

Terms expire 1916

Charles Whiting Baker, editor, *Engineering News.*
Roy D. Chapin, Detroit, Michigan.
Austin B. Fletcher, State highway engineer, Sacramento, California.
James S. Harlan, chairman, Interstate Commerce Commission.
L. E. Johnson, president Norfolk and Western Railway Company.
Joseph W. Jones, New York City.
Alfred Noble, past president, American Society of Civil Engineers.
Thomas G. Norris, president, Arizona Good Roads Association.

Honorary Member

M. Jean de Pulligny, Director of the French Mission of Engineers in the United States.

Sustaining Members

American Road Machinery Company
Arents, Miss Grace E.
Association American Portland Cement Manufacturers
Atlantic Coast Line Railroad Company
Barber Asphalt Paving Company
Barrett Manufacturing Company
Beatty, W. T.
Butterworth, William
Canada Cement Company, Ltd.
Carnegie, Andrew
Case, J. I., Threshing Machine Company
Chicago Portland Cement Company
Chicago, Rock Island and Pacific Railway Company
Cullinan, H. J.
Cullinan, J. S.
Davis, Charles Henry
du Pont, Coleman
du Pont, Pierre S.
Edison Portland Cement Company
El Paso and Southwestern System
Illinois Central Railroad Company
International Harvester Company
Lathrop, Bryan
Lapham, J. H.
Laughlin, James, Jr.
Long, R. A.
National Cash Register Company, The
National Paving Brick Manufacturers Association
Noble, Alfred
Oglebay, Hon. Earl W.
Ryan, Thomas F.
Schiller, William B.
Seaboard Air Line Railway
Sewall, Arthur W.
Solvay Process Company, The
Standard Oil Company of New York
Thompson, Col. Robert M.
Tufts, Leonard
United States Asphalt Refining Company, The
Universal Portland Cement Company
Warner Company, Charles
Warren Brothers Company
Watson Wagon Company

Regular Members

Abbott, D. E.
Abbott, D. K.
Abney, William O.
Achelis, Fritz
Adams, Byron S.
Adams, Joseph
Adams, J. C.
Adams, J. D., & Company
Adger, John B.
Affleck, B. F.
Ahlbrandt, G. F.
Ailes, Milton E.
Albert, J. Taylor
Albright, J. J.
Alderson, Charles M.
Alexander, Charles B.
Alexander, Herbert L.
Alexandre, Mrs. John E.
Allen, Benjamin
Allen, E. M.

Allen, F. R.
Allen, George W. H.
Allen, J. E.
Allen, T. Warren
Alliance Clay Product Company
Alsdorf, W. A.
Alsen's American Portland Cement Works
Alton Brick Company
American Hoist & Derrick Company
Amies Asphalt Co.
Amos, George E.
Anderson, Gen. Clifford L.
Anderson, David G.
Anderson, Edward L.
Anderson, Mrs. Edward L.
Anderson, Frank Bartow
Anderson, Henry B.
Anderson, Henry W.
Angle, Charles M.
Anschuts, H. E.
Ansley, Edwin P.
Archbald, Joseph A.
Asheville Motor Club
Asphalt Block Pavement Co.
Aston, William H.
Astor, W. Vincent
Atha, Howard D.
Atherton, Peter Lee
Atkinson, H. M.
Atkinson, S. T.
Atlantic City Hotel Men's Assn.
Atlas Portland Cement Company, The
Atwater, A. A.
Auburn Wagon Company
Avis, S. B.
Ayres, Ernest F.

Babb, Frank H.
Babcock, F. R.
Bacon, Miss E. S.
Baily, Albert L.
Bailey, Benjamin F.
Baird, W. E.
Baker, Charles Whiting
Baker, Col. George C.
Baker, M. W.
Baker, Robert D.
Ball, James F.
Bannister, E. C.
Banting, C. C.
Barber, C. S.
Barbour, J. K.
Barbour, W. T.
Barnes, J. Lee
Barney, Charles D.
Barr, J. H.
Barrett, Robert
Barron, James S.
Bartlett, George S.
Bartol, George E.
Batchelder, A. G.
Batchellor, F. G.
Bates, Mrs. A. E.
Bates, Adelmer M.
Bates, B. L. M.
Bates Onward
Bauer, Jacob L.
Baughman, E. A.
Bayliss, Charles W.
Beall, John S.
Beard, H. C.
Beatty, Frederick
Beatty, S. F.
Beck, J. P.
Beck, Raymond
Bedford, Thomas A.
Beecroft, David
Beeghley, Lloyd
Beeman, R. H.
Beer, Dr. Oscar B.
Beers, W. D.
Behrens, H. F.
Beidler, Francis
Belden, James M.
Bell, A. S.
Bell, Albert T.
Bell, Alfred W.
Belvin, Preston
Bennett, Charles J.
Bennett, Louis
Bennett, W. M.
Bensel, John A.
Bentley, Cyrus
Bermingham, Walter A.
Berquist, J. G.
Bernheim, Robert B.
Besch, C. G.
Besley, Mrs. Charles Howard
Bigelow, Edward M.
Big Four Clay Company, The
Biggs, Dr. Hermann M.
Billingsley, James W.
Billings, S. O.
Birdsboro Stone Company
Birmingham Slag Company
Birsonett, R. D.
Bixby, Gen. W. H.
Black, John A.
Black, Gen. John C.
Blackistone, Z. D.
Blakeley, A. G.
Blair, C. C.

Blair, Will P.
Blaker, G. H.
Blanchard, Arthur H.
Blanchard, C. A.
Bloch, Jesse A.
Blodgett Construction Company
Board of Commerce of Red Bank
Board of Park Commissioners
Bodine, Samuel T.
Bolling, George W.
Bond, S. N.
Bonham, H. L.
Boocock, Murray
Bourland, R. R.
Boury, Louis J.
Bovard, W. O.
Bowen, Henry S.
Bowers, George M.
Bowlby, Henry L.
Bowman, E. L.
Bowman, H. A.
Bowman, Thomas B.
Bowne, Mrs. Samuel W.
Boyd, D. C.
Boyd, John Y.
Boyer, Edward D.
Boyeson, A. E.
Boykin, L. E.
Boynton, C. W.
Boynton, Jesse L.
Boynton, Walter C.
Bradley, Mrs. Charles
Bradt, S. E.
Brady, Samuel D.
Branch, M. C.
Branch, Prof. T. P.
Brantley, William G., M. C.
Brast, Edward
Breckinridge, Alexander N.
Breese, W. E., Jr.
Bregenser, C. E.
Briggs, B. A.
Bristol Board of Trade
Britton, Roy F.
Brobston, Joseph
Brodrick, W. S.
Brooks, James C.
Brooks, Peter C.
Brooks, Mrs. Reginald
Brooks, R. E.
Brown, Charles C.
Brown, Frank L.
Brown, F. P.
Brown, George Warren
Brown, Lathrop
Brown, L. G.
Brown, L. K.
Brown, Martin L.
Brown, W. C.
Brown, William G., Jr., M. C.
Browne, A. B.
Browning, J. Hull
Browning, William H.
Brownson, Rear Admiral Willard H
Bruce, Frederick
Bryan, John Stewart
Bryan, T. Edward
Bryant, Hughes
Buchanan, Frederick T.
Buck, Church
Buckingham, John R.
Buffum, Col. Frank W.
Burch, Geo. A.
Burch Plow Works Company, The
Burgevin, Julius E.
Burlew, Gen. N. S.
Burnham, Mrs. J. A.
Burnley, J. G.
Burrell, B. H.
Bush, B. F.
Bush, S. P.
Butler, Charles Henry
Byrd, H. F.
Byrd, William

Cabell, Col. Henry C.
Caley, Frederick H.
Calkins, R. M.
Cameron, Col. Bennehan
Campbell, A. W.
Campbell, Charles W.
Campbell, George H.
Campbell, Judge I. K.
Campbell, William
Canada Creosoting Co. Ltd.
Canadian Engineer
Capito, Charles
Carey, Arthur A.
Carmichael, Otto
Carpenter, George Boone
Carpenter, G. V.
Carr, Gen. Julian S.
Carter, Gale Augustus
Carter, H. R.
Carter, Thomas N.
Case, E. J.
Caswell, F. B.
Catlin, Theron E.
Chalfant, Miss Isabella C.
Chalmers Motor Company of Missouri
Chamber of Commerce, Birmingham, Ala.

Chamber of Commerce, Fall River, Mass.
Chamber of Commerce, Olean, N. Y.
Chamber of Commerce, San Diego, Calif.
Chapin, R. D.
Chaplin, B. M.
Chapman, Floyd S.
Chase, L. C., & Company
Cherry, W. I.
Chester, F. J.
Chester County Road Supervisors Association
Childs, Richard T.
Chilton, Maj. Joseph E.
Chilton, Hon. William E., U. S. S.
Chittenden, W. J., Jr.
Chorpening, George B.
Christensen, Engineering Co.
Christie, Lindsay R.
Chubb, Percy
Clack, James M.
Clark, C. M.
Clark, Herbert V.
Clark, James B.
Clark, Dr. L. H.
Clark, T. R.
Clarke, Vincent B.
Clarkson, J. D.
Classen, Charles H.
Clay, Buckner
Clemans, W. M.
Clements, Charles
Cleveland Stone Company
Clifford, R. J.
Clohan, Alexander
Clover, Rear Admiral Richardson
Club Journal, The
Clyde, William P.
Cobb, Lamar
Cobb, Murray A.
Cochrane, J.
Coffman, C. C.
Cohen, Samuel
Coke, John A.
Colgrove, P. T.
Collier, Robert J.
Collins, Justus
Colorado to Gulf Highway Assn.
Commercial Club of Omaha
Commons, John J.
Commonwealth Steel Company
Compton, R. Keith
Concrete Age, The
Concrete Form & Engine Company
Congdon, R. C.
Connable, Frank L.
Connell, William H.
Conner, A. W.
Conover, Charles H.
Conoway, Waitman H.
Conrad, O. A.
Converse, Frederick S.
Cook, James H.
Cook, Joe R.
Cooke, C. B.
Cooley, George W.
Coombs, F. E.
Cooper, C. J.
Cope, R. L.
Cornwell. John J.
Cornwell, Wm.
Corpus Christi Commercial Club
Corthell, Elmer L.
Cottman, J. H.
Courtney, Dr. David H.
Cox, Hon. James M.
Cox, Dr. John W.
Coxey, Gen. J. S.
Coyle & Richardson
Craig, Benjamin L.
Craney, A. H.
Cranford, J. H.
Cranford, Percy
Cranmer, W. H. H.
Crapo, S. T.
Craver, H. H.
Crescent Portland Cement Company
Cresson, James
Cressy, Walter
Crosby, W. W.
Culp, J. M.
Cunningham, A. M. T.
Cuppett, D. E.
Curtis, W. E.
Cushman, Dr. Allerton S.
Cutter Frank G.

Dalton, H. G.
Dameron, Edward Caswell
Damon, George A.
Dana, Charles S.
Dana, S. F.
Darlington, N. D.
Davidson, L. D.
Davis, Charles Henry
Davis, Hon. Henry G.
Davis, John T.
Davis, John W., M. C.
Davis, William J.
Davison, F. B.
Dean, Mrs. S. Ella Wood
Dearborn, George S.
Dearborn Drug & Chemical Works
Decker, R. W.

Deckman-Duty Brick Co.
Deeds, D. D.
Deer, A. J.
Delano, F. A.
Demming, Col. Henry C.
Denham, S. C.
Denman, Walter M.
Denys, Rev. F. Ward
Dew, Charles
Dewey, Albert B.
Dewey Portland Cement Company
Diamond Portland Cement Co.
Dice, Charles S.
Dickinson, John Q.
Dickinson, John W., Jr.
Dickinson, W. W.
Diehl, George C.
Dille, Thomas Ray
Dillon, Charles W.
Dixie Culvert & Metal Co.
Dixie Portland Cement Company
Dodge, A. Douglas
Dodge, C. P.
Donaldson, Capt. Thos. J.
Donaldson, W. E.
Donelson, J. E.
Donley, Edward G.
Donley, William McClary
Dorr, Charles P.
Dougherty, Rev. George A.
Douglas, E. B.
Dow, A. W.
Downing, H. H.
Downing, J. F.
Doyle, Harry S.
Draney, Joseph R.
Dudley, C. H.
Duff, John J.
Dull, C. W.
Dulles, William
Dumond, L. A.
Duncan, N. W.
Dunlop, R. A.
Dunn, W. R.
Dunning, A. B.
Dunning, W. B.
du Pont, Irenee
du Pont, Lammot
Duquesne Slag Products Co.
Durbin, Charles R.
Durham, Henry W.
Dye, William Holton
Dyer Quarry Co., The John T.

Earle, Horatio S.
Easby, William, Jr.
Eckley, S. W.
Edison, Thomas A.
Edison Portland Cement Company
Edmiston, Andrew
Edson, J. J.
Edwards, J. H.
Edwards, William Seymour
Egleston, Howard
Elbring, Wm.
Eldridge, M. O.
Elkins, Blaine
Elkins, Davis
Elkins, George W.
Elkins, Mrs. Hallie D.
Ellerson, A. R.
Ellis, Fred E.
Ellis, W. Dixon
Elton, John P.
Emery, Mrs. Thomas J.
Emmons, Arthur B.
Endicott, John
Ennis, John
Eno, William P.
Engineering & Contracting
Enslow, Frank B.
Essex County Park Commission
Eureka Machine Co.
Evans, Walter A.
Ewald, Dr. Louis A.
Ewing, F. G.

Fallis, W. S.
Fairmont Chamber of Commerce
Farmers Loan & Trust Co. of New York City
Farnam, Henry W.
Farnam, William W.
Farquhar, A. B., Company, Ltd.
Farrar, F. E.
Farris, William
Faulkner, Hon. Charles J.
Fauss, Geo. H.
Faust, H. K.
Fay, F. T.
Fegenbush, Chas. J.
Felker, Samuel S.
Felton, S. M.
Fenner, H. N.
Ferguson, G. M.
Field, Barker & Underwood, Inc.
Filbert, Richard Y.
Filbert Paving & Construction Company
Finley, Sam L.
First National Bank, Huntington, W. Va.
Fisher, Charles Robert
Fisher, Henry

Fitzgerald, P. S.
Flagg, Ernest
Flanigan, P. & Sons
Fleming, Hon. A. Brooks
Fleming, A. Howard
Flenniken, John W.
Fletcher, Austin B.
Flickwir, David W.
Flinn, George H.
Follett, A. D.
Forbes, Blanchard S.
Ford, Frank T.
Ford, William H.
Foster, Samuel D.
Foster Motor Car Company
Fout, Maj. J. H.
Fownes, H. C.
Fox, Fred J.
Frame, E. C.
Francis, Geo. E.
Francis, M. J.
Francis, William M.
Fraser, Miss J. K.
Fraser, John P.
Frederick Hotel Company
French, Samuel H., & Company
French Walter S.
Fuchs, George
Fuller, Almon H.
Fulweiler, Walter Herbert
Fulwell, George

Gaff, T. T.
Gaffey, John A.
Gaines, Clement C.
Gaines, J. Russell
Gallagher, Austin
Gallaher, John T.
Gardiner, Asa Bird, Jr.
Garlick, H. M.
Garneau, Joseph
Garner, James A.
Gartland, John J., Jr.
Gaskill, Edwin A.
Gaston, Miss Sarah H.
Gay, Louis W.
Gaylord, W. A.
Gaynor, James L.
Gearhart, W. S.
German-American Portland Cement Works
Gerstell, A. F.
Gilbert, Hugh C.
Gilbert, Seymour P.
Gilbreath, W. C.
Gillespie, John S.
Gillette, Charles F.
Glass, Frank P.
Glens Falls Portland Cement Company
Glover, A. M.
Glover, Charles C.
Goddard, L. H.
Godwin, W. S.
Goe, R. T.
Goff, Guy D.
Golsan, H. L.
Good, D. M.
Goodell, John M.
Goodfellow, Hugh
Goodhue, A. J.
Goodlett, Earl G.
Goodrich, The B. F., Company
Good Roads Association, Lafayette, La.
Goodyear Tire & Rubber Co.
Gordon, M. E.
Gordon, William F.
Gorrill, Mrs. Charles H.
Gowen, Albert Y.
Graham, F. W.
Grant, E. M.
Grant, John W.
Grasselli, C. A.
Graves, H. S.
Gray, James R.
Gray, R. S.
Green, Henry S.
Greenlee, C. F.
Greer, George
Gregg, John M.
Grey, Norman
Griffith, C. J.
Griffith, D. J.
Griffith, Robert E.
Grigg, Jerome B.
Grosscup, Col. Fred Paul
Grovall, William H.
Grove, William J.
Groves, E. W.
Grundy, Barton H.
Gully, Cuthbert
Gunlogson, G. B.
Gurley, W. & L. E.
Gustafson, E. N.
Guy, William E.

Hackney, John W.
Haden, C. J.
Hadley, Howard D.
Haggerty, G. W.
Haggerty, John S.
Hague, William
Haines, H. S.

Hall, A. Acton
Hall, Chas. M.
Hall County Commissioners
Hammond, John Hays
Hammond Fire Brick Company
Hamilton, Dr. M. F.
Hancher, Charles N.
Hanes, P. H.
Harding, W. H.
Hardison, Parker L.
Hardy, Caldwell
Harlan, James S.
Harman, T. D.
Harrington, Walter G.
Harris, Graham H.
Harrison, Archibald
Harrison, Fairfax
Harrison & Dean
Harry, H. L.
Hart, Charles B.
Hart, Charles M.
Hart, F. T.
Hart, John B.
Hartley, G. B.
Hartley, J. M.
Hartranft, Wm. G.
Hartranft, William G., Cement Company
Harvey, Col. George
Harvey, W. H.
Hassinger, W. H.
Hatfield, Gov. H. D.
Hawblitz, L. H.
Hawley, J. H.
Hawn, Warren
Hayes, James R.
Hay, Mrs. John
Hays, E. A.
Hazard, Miss Caroline
Haslett, Howard
Haslett, Robert
Head, Frazier A.
Head, James M.
Headley, W. T.
Heap, S. Lawrence
Hearne, Julian G.
Hearne, Thomas McK.
Heasley, Veeder
Hedrick, T. J.
Heller, W. C.
Helm, William F.
Hemstreet, George P.
Henderson, George A.
Henderson, Judge R. R.
Henderson, Thomas
Hennen, Robert D.
Hennessy, Edward
Henry, Samuel J.
Henry, Philip W.
Hering, H. G., Jr.
Hess, E. W.
Heurich, Christian
Hewson, J. H.
Heyl, George A.
Hill, Curtis
Hill, H. C.
Hillyer, Wm. H.
Hinchman, Walter S.
Hines, Edward N.
Hite, William F.
Hitt, William F.
Hittig, William
Hockaday, R. W.
Hocking Valley Brick Company
Holcombe, William H.
Holland, Arthur
Holloway, James J.
Holly, James A.
Holman, W. A.
Holmes, Walter H.
Holt, John H.
Holt Caterpillar Company
Homes, M. Goode
Hood, C. A.
Hood, Frederic C.
Hood, O. A.
Hoover, Fred R.
Hopkins, J. J.
Hopkins, J. M.
Hornor, Boyd E.
Hough, Elmer
Houk, Mrs. Eliza
Hotel Charleraix
Hotel Kanawha Company
Houser, Fred
Howard, Edgar B.
Howard, J. W.
Hower, M. Otis
Hubbard, Dr. Harry
Hubbard, Russell S.
Hudson, Clark
Hudson, Hendrik
Hudson, J. Frank
Hudson, J. I.
Huey, J. O.
Huff, Francis J.
Hughes, Hector J.
Hughes, James A.
Hughes, Richard H.
Huhn, W. H. T.
Huidekoper, Prescott
Hulen, John A.
Humboldt County Good Roads Club

Hume, S. W.
Humphrey, D. S.
Humphrey, Harry J.
Humphreys, A. E.
Hunt, Capt. Robert W.
Hunter, The Rev. John D.
Hunter, Ross
Hunton, Eppa, Jr.
Huron Portland Cement Co.
Hurt, H. H.
Huston, Archibald H.
Huston, Miss Florence L.
Huston, Mrs. Julia S.
Hutchinson, C. L.
Hutchinson, F. S.
Hutchinson, George W.
Hutton, Col. Elihu
Hvass, B. Charles
Hyde, Thomas

Ice, William B., Jr.
Ingersoll-Rand Company
Ingram, George M.
International Motor Company, Kansas City
Irby, W. O.
Irvine, W. B.

Jacobus, Worthington M.
Jackson, Mrs. F. E.
Jackson, Malcolm
Jackson, R. B.
Jacob, Henry G.
Jaeger Machine Company
Jaicks Company, A.
Jaques, Herbert
Jaques, H. P.
James, Dr. E. J.
Jefferson, The Hotel
Jeffress, Thomas F.
Jenkins, J. B.
Jenks, Geo. J.
Jennings, Miss A. B.
Jennings, Hennen
Jennison, H. G.
Jewett, W. O.
Johnson, A. N.
Johnson, A. S.
Johnson, Charles J.
Johnson, John D.
Johnson, M. B.
Johnston, John A.
Johnson, John H.
Johnson, J. R.
Johnson, L. E.
Jones, Dwight A.
Jones, Edwin P.
Jones, Frederick
Jones, Isaac B.
Jones, James Ellwood
Jones, Joseph W.
Joplin Free Public Library
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Joseph, Chester V.
Joyner, F. H.
Judson, O. H.

Kauffman, O. F.
Keene, Foxhall P.
Kehr, Cyrus
Keister, D. P.
Keith, Sidney W.
Keller, Herbert P.
Keller, W. S.
Kellogg, Miss Emma C.
Kelley, Frederick W.
Kelley, William V.
Kelsey, Clarence H.
Kelsey, E. H.
Kendall, Amos
Kendall, Chas. H.
Kendrick, Arthur
Kennedy, Dennis A.
Kennon, Lieut.-Col. Lyman W. V.
Kenyon, Clarence A.
Kerr, Charles M.
Kersey, Harvey
Kershaw, William H.
Keyes, Dr. Edward L.
Keyes, John M.
Kidd, Robert F.
Kilbourn, C. W.
Kilbury, J. S.
Kilmer, George L.
Kimball, A. R.
Kinch, D. C.
King, H. V. D.
King, James P.
King, Rupert C.
King, Mrs. Grace Marvin
Kingsley, E. A.
Kinney, Wm. M.
Kirkland, John L.
Kittle, Warren B.
Knapp, Judge Martin A.
Knickerbocker Portland Cement Co.
Knight, A. R.
Knight, C. D.
Knight, E. W.
Koehring Machine Company
Koen, E. B.
Koen, J. T.
Koiner, Hon. George W.

Kramer, Xavier A.
Krumbholz, T. Edmund
Laing, A. T.
Laing, Edward M.
Laird, H. C.
Lambert, H. L.
Landenberger, J. M.
Landers, George M.
Landon, Alvin W.
Lane, H. L.
Lane, J. E.
Lane, P. E.
Langan, H. B.
Langevin, Aimee
Lantz, Edward
Lapham, Lewis H.
Larcombe, John S.
Larkin, John D.
Laughlin, George A.
Laughlin, James, 3d
Laughlin, Ott
Lavery, John Y.
Law, W. E.
Lawson, Victor F.
Lawton, A. J.
Layne, Dr. Ernest
Layton, Hudson F.
Lazear, J. S.
Leahy, Dr. W. J.
Lee, Arthur
Lee, Blair
Lee, Lawrence R.
Lee, W. I.
Legare, Alexander B.
Leggett, H. J.
Leigh, Egbert G., Jr.
Lemon, Walter B.
Lesley, Robert W.
Leslie, M. G.
Lesner, John A.
Letton, J. F.
Levinson, H.
Lewis, Arthur S.
Lewis, C. Cameron, Jr.
Lewis, E. G.
Lewis, W. H.
Light, Charles P.
Lilley, George M.
Lincoln, A. T.
Lincoln, S. Dana
Lindsay, Gordon I.
Linnell, F. J.
Lippincott, James J.
Lloyd, H.
Lloyd, Horatio G.
Lober, John B.
Lock Joint Pipe Co.
Logan, James
Lombard, P. H.
Long, George
Long, J. H.
Long, Joe L.
Longfellow, Miss Alice M.
Loring, D. A., Jr.
Los Angeles Chamber of Commerce
Louis, John C.
Lowe, Col. J. M.
Lowery, T. A.
Lowndes, Richard T.
Lucas, C. F.
Lufkin, E. C.
Luke, David L.
Luten, A. B.
Luten, Daniel B.
Lutz, George W.
Lyon, Charles L.
Lyon, Frank D.
Lytton, Henry C.

McAndrew, Aeneas
McAvoy, John C.
McCamic, Charles
McCarthy, Charles R.
McCay, H. K.
McClaren, W. J.
McClintock, J. Y.
McCluer, William B.
McClung, Hon. Lee
McCombs, A. S.
McConaughey, William C.
McConnell, E. B.
McCord, Alvin C.
McCormick, Prof. E. B.
McCormick, Harold F.
McCormick, Vance C.
McCrady, Thomas
McCrea, W. S.
McDaniel, J. U. C.
McElroy, James A.
McGarry & Co., John A.
McGill, J. Nota
McGlynn, Hugh A.
McGovern, T. J.
McGrath, George B.
McGraw, James H.
McGraw, John T.
McGuire, F. J.
McGuire, James K.
McGuire, Dr. Stuart
McIlvaine, William D.
McKell, William
McKinley, J. C.
McKinley, William B.
McKinstry, K. T.

McLain, F. J.
McLaughlin, Harry A.
McLean, Hon. W. A.
McLure, B. S.
McMillan, Mrs. James
McMillan, Philip H.
McMorris, D. W.
McNamee, George A.
McNeil, Donald
McPherson, A. J.
McPherson, S. J.
McQueen, J. R.
McVettie Dr. R. R.
MacAlester, Charles
MacArthur, John R.
MacBurney, John M.
MacCorkle, William A.
MacDonald, Heber
MacDonald, H. H.
MacDonald, James H.
Mackall, W. W.
MacKendrick, W. G.
MacLean, R. J.
Maddox, Samuel
Magid, Louis B.
Magrath, C. A.
Mahoney, M. V.
Mann, Edwin
Mann, Isaac T.
Manning, Frank J.
Manning, J. R.
Manning, Warren H.
Marble, Mrs. Frank
Marcuse, Milton E.
Marden, Robert F.
Marion Steam Shovel Co.
Markham, George D.
Marker, James R.
Marsteller, J. H.
Martin, A. D.
Martin, Mrs. Eleanor
Martin, E. W.
Mason, George G.
Massey, L. C.
Masters, W. M.
Mather, William G.
Mathews, William B.
Mathewson, E. P.
Mathews, William R.
Maxwell, Haymond
Maxwell, Lee
Maxwell, W. Brent
Mayer, Edwin C.
Mayo, John C. C.
Mayo, P. H.
Meals, S. W.
Means, A. E. N.
Mehren, E. J.
Meridian Road Association
Merillat, P. C.
Merydith, Edward A.
Meserve, H. Fessenden
Meservie, W. R.
Metcalf, Morris
Metager, William E.
Meyer, Edwin O.
Michigan Portland Cement Company
Michaud, B.
Mims, Mrs. Sue H.
Miller, A. C.
Miller, A. Ford
Miller, Edward
Miller, F. E.
Miller, Guy D.
Miller, John A.
Miller, R. T.
Miller, Walton
Miller, Judge William N.
Miller Engineering & Construction Company
Millhiser, Clarence
Mills, Morgan R.
Miner, H. A.
Miner, Joshua L.
Mingea, W. E.
Minker, H. M.
Mitchell, Samuel
Mitchell, W. K.
Mize, R. D.
Moat, O. J.
Mockler, C. N.
Mohun, Barry
Monfort, G. F.
Moody, Geo. T.
Moore, Clinton H.
Moore, Everett L.
Moore, George N.
Moore, J. Hampton, M. C.
Moore, J. M.
Moore, S. A.
Moores, F. Lawson
Moors, E. J.
Moote, Adelbert
Morford, Denton
Morgan, S. T.
Morley, C. R.
Morrill, C. W.
Morrison, Edwin J.
Morris, Tusca
Mosely, F. S.
Moss, Frank
Moss, Hunter H., Jr., M. C.
Mossman, Dan A.

Mott, Chares S.
Moyer, Albert
Mudd, Dr. H. G.
Mullis, Ira B.
Murphy, Edward
Murphy, J. E.
Murphy, Thos. D.
Murray, Oscar G.
Myers, Lilburn T.

Nabb, C. H.
Nagle, G. O.
Nast, Conde
National Building Supply Company
Naylor, R. B.
Neely, Harry J.
Nelson, Lyman H.
Nelson, T. M.
Nelsonville Brick Company, The
Neuman, James V.
New Aetna Portland Cement Co.
Newago Portland Cement Co.
Newcomb, Howard R.
Newcomb, William T.
Newell, A. T., & Brother
New Castle Portland Cement Company
Nichols Contracting Company
Noah, A. H.
Norman, Guy
Norris, T. G.
N. C. Good Roads Association
Northcott, G. A.
Northrop, Claudian B.
Nyman, Howard S.

Oakes, Francis H.
Ochs, Adolph S.
Oglebay, Crispin
Ohley, William A.
Oklahoma Portland Cement Company
Olcott, Dudley
Oliver Chilled Plow Works
Oliver, J. A.
O'Neill, J. Denny
Orenstein-Arthur Koppel Co.
Osenton, Charles W.
Osgood, C. F.
Osgood, M.
Owen, James
Owen, Hon. Robert, U.S.S.
Owen, R. M.

Padgett, R. J.
Page, Carroll S., U.S.S.
Page, Legh R.
Page, Logan Waller
Page, Louis R.
Page, S. Davis
Page, Walter H.
Paige, A. W.
Palmatary, J. T.
Palmer, Mrs. Potter
Park Automobile Company
Parker, A. D.
Parker, Harold
Parkhurst, J. Reed
Parsons-Souders Company, The
Passano, Edward B.
Patten, H. J.
Patterson, John H.
Patterson, John L.
Patterson, M. C.
Pattno, Frank P.
Paull, Alfred W.
Payne, James M.
Pearce, W. G.
Pearson, C. J.
Pearson, R. P.
Peerless Portland Cement Co.
Pelouze, E. C.
Pemberton, E. L.
Pemberton, Robert L.
Pence, A. P.
Penfield, L. W.
Penfield, R. C.
Peninsular Portland Cement Co.
Penland, John R.
Pennington, E.
Pennsylvania State Library
Pennybacker, J. E.
Peoples Trust Company
Perkins, Chas. E.
Perkins, George H.
Perkins, Hamilton
Perkins, Seth, Jr.
Perkins, Wm. C.
Peters, C. C.
Peterson, B. W.
Pettibone, Mulliken & Company
Pfeiffer, Jacob
Philip, J. Van Ness
Philips, S. Jones
Phillips, Charles R.
Phillips, John F.
Phillips, J. W.
Phillips, W. S.
Philpot, C. M.
Phoenix Portland Cement Co.
Piatt, W. H. H.
Piedmont Hotel
Pierce, Daniel T.
Pierrepont, R. Stuyvesant

Pierrepont, Seth L.
Pillsbury, Franklin C.
Pindell, William M.
Pleak, W. R.
Pochelon, Albert
Poffenberger, Judge George
Polk, Dr. W. M.
Pollard & Bagby
Poole, John
Poole, J. L.
Portage Silica Co., The
Porter, Alexander J.
Porter, Capt. John
Portland Cement Company of Utah
Post, Ira C.
Potter, Dell M.
Potter, D. R.
Potter, Frank W.
Potter, N. S.
Potts, Robert J.
Powel, Mrs. Samuel
Powell, Charles
Powell, P. W.
Powers, E. L.
Pratt, Dr. Joseph Hyde
Pratt, R. H.
Price, Andrew
Price, Charles P.
Price, Francis A.
Price, Oscar A.
Prichard, A. W.
Priest, H. W.
Pringle, E. J.
Pritchard, Dr. L.
Procter, R. T.
Puffer, S. P.
Pugh & Hubbard Company
Pulitser, Ralph
Pullar, Harold B.
Purdue University Library
Putnam, A. H.

Quarles, Edwin L.
Quincy, C. F.

Rablin, John R.
Rader, B. H.
Railsback, W. S.
Rainbow Route Through Colorado, The
Ramsdell, William M.
Ramsey, W. H.
Randall, Theodore A.
Randolph, Isham, & Company
Rankin, A. M.
Ransome, Ernest L.
Rapallo, C. A.
Rathman, Otto
Raymond, A. G.
Raymond. A. W.
Reay, David C.
Redfield, Charles H.
Redwood, John
Reed, Alexander
Reel, C. Gordon
Reimer, Frederick A.
Remington, Franklin
Renkert, H. S.
Repair, John F.
Rice, L. M.
Richards, J. Donald
Richardson, Clifford
Richardson, J. F.
Richards, Robert H.
Richards, W.
Riegel, John I.
Riggs, E. Francis
Rinehart, Lloyd
Rinehart, Col. W. A.
Ritter, Charles F.
Ritter, C. Lloyd
Ritz, Harold A.
Robbins, Francis L., Jr.
Roberts, Thomas
Roberts, W. J.
Robeson, D. S.
Robeson, Mrs. Harriet R.
Robeson, J. S.
Robinson & Ross
Robinson, Cecil A.
Rochester, P. W.
Rock Products
Rodgers, P. B.
Rohn, Oscar
Roosevelt, R. B.
Rourke, L. K.
Rowland, L. M.
Rumsey, Mrs. Dexter P.
Runnells, J. S.
Russell, Frank
Russell Grader Mfg. Co.
Ruth, J. W.
Rutter, Mrs. David

Salen, Charles P.
Sampsell, P. D.
Sanders, Herbert W.
Sanders, Joseph M.
Sanderson, Prof. E. Dwight
Sands, Daniel C.
Sands, Lawrence E.
Sands, Oliver J.
Sargent, William D.
Scales, George C.

Scates, John C.
Schaub, J. G.
Schlegell, Max von
Schlegell, A. von
Schofield, Prof. W. H.
Scholle, Gustave
Schutte, August E.
Scott, Fred W.
Scott, George Cole
Scott, Hon. Nathan B.
Scott, R. P.
Screeton, E. R.
Sebold, R. P.
Security Cement & Lime Co.
See, George C.
Seely, Ray
Seested, H.
Seits, D. W.
Serey, J. T.
Sevier, L.
Shapleigh, A. L.
Sharkey, James L.
Sharples, Philip P.
Shattuck, A. R.
Sheldon, Edwin B.
Shepard, Finley J.
Shepherd, John A.
Shepley, Ether L.
Shirley, Henry G.
Shoemaker, Ira H.
Shorey, H. S.
Short, Clarence A.
Simard, George A.
Simmons, George W.
Simms, John T.
Simpson, S. C.
Sinclair, D. J.
Sinnickson, George R.
Sirrine, William G.
Sisson, W. D.
Skelton, Gordon V.
Skidmore, C.
Slemp, C. Bascom, M. C.
Slick Brothers Construction Co.
Smith, Dr. A. Alexander
Smith, A. Crawford, Jr.
Smith, Blaine
Smith, B. M.
Smith, Byron L.
Smith, C. H.
Smith, Charles H.
Smith, Fred F.
Smith, H. F.
Smith, James Elmo
Smith, J. R.
Smith, R. A. C.
Smith, S. P.
Smith Company, The T. L.
Smith, Victor C.
Smith, W. D.
Smith, W. T.
Smoot, L. D.
Sohier, Col. William D.
Southern Appalachian Good Roads Association
Soutter, James T.
Spalding, A. G.
Spaulding, E. H.
Speed, J. B., & Company
Speer, Joseph McK.
Speidel, Joseph, Jr.
Spencer, Herbert
Spencer, H. B.
Spencer, W. B.
Spilman, Gen. B. D
Sprague, Albert A.
Sprague, Albert A., 2d.
Sproul, William Cameron
Sprunt, James
Stahlman, Maj. E. B.
Standard Lime & Stone Co., The
Standard Portland Cement Co.
Stanley, L. T.
Stapleton, L. L.
Staunton, Fred M.
Stearns, Irving A.
Steele, Charles
Stephenson, Dr. E. B.
Stephenson, Samuel
Stephenson, Mrs. Walter B.
Sterling, J. M.
Sterling, Robert B.
Stern, Ira G.
Stetson, Francis Lynde
Stevens, Rear Admiral T. H.
Stevens, Mrs. T. H.
Stevenson, A. E.
Stevenson, William H.
Stewart, James H.
Stewart, John W.
Stewart, Spencer J.
Stinchcomb, W. A.
Stockmann, C., Jr.
Stokely, J. T.
Stokes, Anson Phelps
Stone, Charles A.
Stone, W. E.
Stone, W. G.
Stoney, Samuel G.
Storrow, James J.
Stowell, Harley L.
Strahan, Prof. C. M.
Stringham, Joseph S.
Stroh, Julius

Strong, Frederick Steele
Stroop, William
Strickling, James H.
Strother, James A.
Stuart, Henry C.
Stuart, Jerome W.
Stuck, B. F.
Studebaker Brothers Manufacturing Company
Sucro, William G.
Suggs, Sidney
Sullivan, D. P.
Summers, U. Grant
Sumner, Eliot
Sunderland, L. T.
Sutherland, Howard, M. C.
Swan, Charles F.
Sweeney, E. R.
Sweeney, Thomas B.
Swett, Bertram L.
Swift, William H.
Swineford, Howard, & Son
Swisher, Charles W.

Taber, Mary
Taft, Robert V.
Talbert, Charles M.
Tallman, W. H.
Tarrant Manufacturing Company
Taylor, H. C. Chatfield
Taylor, Jesse
Taylor, John
Taylor, William
Taylor, W. O.
Taylor, W. W.
Tejan, Frank
Tennessee Metal Culvert Company
Tenney, George O.
Terhune, Mrs. M. Virginia
Terre Haute Vitrified Brick Co.
Terrell, Robert C.
Terry, Dr. M. O.
Tetrick, W. Guy
Teter, Charles F.
Texarkana Pipe Company
Thacher, Mrs. John Boyd
Thacher, Dr. John S.
Thatcher, Chas. W.
Thayer, G. T.
Thiel, F. J. F.
Thoma. W. C.
Thomas, Mrs. Theodore
Thomson, Walter B.
Thompson, H. W.
Thompson, J. B.
Thompson, Philip L.
Thompson, M. Roy
Thompson, W. R.
Thompson, Mrs. William Reed
Thompson, W. T.
Thurston, R. C. Ballard
Tidewater Portland Cement Co.
Tierney, Lawrence E.
Tipper, Harry
Tompkins, Robert F.
Tory, James C.
Towne, Burton A.
Townsend, Frederick
Townsend, Lawrence
Trainer, J. Ed.
Trayer, W. H.
Trexler, Harry C.
Tribus, L. L.
Trocon, A. A.
Troy, Peter H.
Troy Wagon Works Co., The
Trussed Concrete Steel Co.
Tumlin, E. D.
Turman, S. B.
Tyler, Nat, Jr.

Uihlein, Edgar J.
Ulman, Jacob A.
United Brick Company, The
United Construction Company
United Motor Kansas City Company
Universal Road Machinery Co.

Valentine, Frederick S.
Vanderbilt, W. K., Jr.
Vander Horst, Elias
Vanderlip, Frank A.
Van Doorn, J. C.
Van Dusen-Roys & Co.
Van Horne, Perry
van Westrum, G. S.
Varner, H. B.
Vaughan, J. W.
Vickers, Dr. R. E.

Wade, J. W.
Wade, Dr. S. I.
Waernicke, H. E.
Walcott, Frederic C.
Walker, James, Construction Company
Wallace, Edwin C.
Walter, Dr. H.
Walters, A. L.
Ward, W. H.
Warden, Henry
Wardwell, Allen
Warfield, Harry R.

Warner, John Elliott
Warren, George C.
Warren, Dr. John Collins
Warren, Ralph L.
Washington, Joseph E.
Washington, William De H.
Watson, Clarence W., U. S. S.
Watson, E. J.
Watson, James E.
Watts, George W.
Waugh, Douglas
Waugh, H. Roy
Weatherwax, H. B.
Weaver, I. U.
Weaver, R. S.
Webber, Richard H.
Webber. W. G.
Weller, O. E.
Welsh, Charles N.
Wendell, Barrett
Wents, Frank
Werninger, A. W.
Weston, Joseph
West Virginia Exposition
West, Wylie
Wheeler, Samuel H.
Wheeler, Schuyler Skaats
Whitall, W. Van R.
Whitcraft, Arthur
White, Charles D.
White, Clark
White, George, M. C.
White, Dr. I. C.
White, J. B.
White, M. Z.
White, Mrs. Stanford
Whitham, C. G.
Whitehead & Hoag Co.
Whitelaw, W. M.
Whitin, Prof. E. Stagg
Whitis, Chas. P.
Whitmarsh, Thomas C.
Whitney, Charles M.
Whitney, George L.
Whittaker, A. B.
Wickersham, T. A.
Wilbur, James B.
Wilcox, Walter D.
Wiley, William H.
Wilkinson, O. Jennings
Willets, Howard
Williams, A. Dennis
Williams, Mrs. David Terry
Williams, Frank M.
Williams, George W.
Williams, Herbert L.
Williams, J. Farrand
Williams, James T.
Williams, John Skelton
Williams, Judge L. Judson
Williams, T. C., Jr.
Williams, Waldron
Willits Brothers
Wilson, Blair P.
Wilson, Hugh M.
Wilson, James
Wilson, J. Russell
Wilson, P. H.
Wilson, Capt. P. St. Julien
Wilson, W. E.
Wilson, William G.
Wilson W. R.
Winkler, C. F.
Winn, E. L., Construction Company
Winn, W. Tom
Winchell, Benjamin La. F.
Winslow, D. H.
Winston, W. O.
Wintersmith, J. M.
Wise, George
Witbeck, Albert T.
Witherbee, Frank S.
Withers, J. P.
Wittenburg, A. R.
Wittenberg, Lester
Woddrop, L. H.
Wonders, James C.
Wood, George
Woodbridge, C. E.
Woodruff, Harlan
Woods, George W.
Woodward, Dr. George
Woodward, J. A.
Worrell, Mrs. Elizabeth P. S.
Wood, Maj.-Gen. Leonard
Wood, William P.
Woodyard, Burdette
Woolley, Geo. H.
Work, George E.
Wright, Charles A. L.
Wright, W. N.

Yeatman, Pope
Yoakum, B. F.
Young, H. E.
Young, Dr. Hugh Hampton
Young, M. R.

Zeese, Harry L.